STS-113 Rev 3 *3058581 *

PROCESSING OPERATIONS CONTROL
OMI PLANNING SHEET

Wad Number	SITE	Elem CD	End Item	
S6444-J04-R03	LCC	V	105 FLT: 019	DATE: 11/22/2002 TIME: 20:09:57

Title: SSV ICE AND DEBRIS ASSESSMENT

Sub Element/Zone: 30

Project Work Order No.	Hazard:	SFOC Safety	
	☒ Yes ☐ No	NA	☐ Local Copy ☒ Firing Room Copy

Authorizing Document	Material & Equipment:	MICR Req'd	OMRS:
VPL519	☒ Yes ☐ No	☐ Yes ☒ No	☒ Yes ☐ No

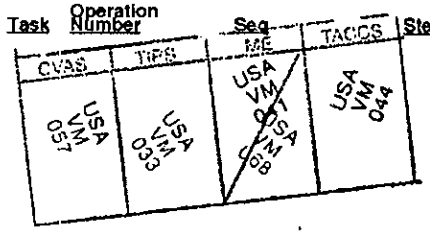
PERFORM THE FOLLOWING:

Pre-Ops Setups

Task	Operation Number	Seq	Steps	Task	Operation Number	Seq	Steps

OPS Support

Task	Operation Number	Seq	Steps	Task	Operation Number	Seq	Steps



Operating Instructions

Task	Seq	Steps	Task	Seq	Steps
	010			080	
	015			090	
	020			100	
	030			110	
	040			120	
	050			130	
	060			140	
	070			150	

Post Ops

Task	Operation Number	Seq	Steps

Appendices

Task	Seq
N/A	

Subtask WAD's

N/A

Planner	WC	Ext	QC Closure	Date	Page
MARSHALL MOORE	032 USA NOV 22 '02	6516		11/23/03	1 OF 1

OMI TASK CLOSEOUT CHECKLIST

OMI No.	Run No.	Task Control No. (TCN)
S6444 J.4	3	3058581
Start Date	**Completion Date**	**Closure Date**
23 November 2002	06 JAN 2003	1/23/03

	QC/Eng.	Date
1. Deviation Index: Verify total number of deviations agree with index. Verify entry is correct into OMI.		JAN 23 '03
2. Constraints: Verify all constraints are cleared.	N/A	N/A
3. IPR's: Verify that all IPR's are closed or upgraded to problem reports or dispositioned as no constraint to OMI closure and incorporated in central IPR system and a copy of the central IPR sort attached.		16 JAN '03
4. Verify that material and equipment requirement list enclosed (if applicable).	N/A	N/A
5. OMI: Verify that all pages or verification sheets are completed, stamped, and dated in the lower left/right hand corners.		JAN 23 '03
6. OMI: Verify that all miscellaneous documents/procedures have sequence number referenced and stamped; e.g., photos, sample results, etc.		JAN 23 '03
7. Planned task/OMI satisfactorily completed. OPR: K. Brewer 01-06-03		16 JAN '03

03-15-2002
APPROVED

OMI S6444 J04
APPROVED

SSV ICE AND DEBRIS ASSESSMENT

Element/End Item: **ALL**
Flow/Usage: **ET-103 & SUBS**
Facility: **LC 39**
Design Center Concurrence: **MSFC,JSC**
Category: **B**
OPR: **ETM**
TTL ORG: **SE**

This document contains HAZARDOUS operations.

KENNEDY SPACE CENTER - SPACE TRANSPORTATION SYSTEM

Table of Contents:

1.0 INFORMATION

1.1 Objective

Provide necessary tasks that document, monitor and evaluate ice and debris conditions to eliminate or minimize debris concerns of the integrated SSV during ET tanking, FRF, launch, and associated detanking.

Description

1. This OMI is performed as subtask to S0007/S0014/S0037.

2. This OMI provides documentation of ice/debris activities:

   A. Pre-launch icing briefing

   B. Pre-launch debris inspection

   C. Countdown - Based timeline evaluation monitoring of ET TPS surfaces using OTV

   D. OTV monitoring of seal/flange areas for cryogenic leakage

   E. SSV OTV monitoring for debris conditions during countdown

   F. Cryogenic replenish inspection for evaluation of SSV and facility debris concerns or anomalies

   G. Evaluation of concerns/anomalies in the event of ET detanking

   H. Review of engineering film data for SSME ignition, launch, ascent, ET separation, and orbiter landing.

3. Orbiter landing debris information is contained in the NASA publication for Ice and Debris Assessment. That report is referenced in this OMI for continuity of debris data.

1.2 Special Instructions All Operations

1. This OMI is run as a subtask to OMI's S0007, S0014, and S0037. All PAD clearing and controlled access operations will be performed per those OMI's.

2. Constraints will be statused by controlling OMI's S0007/S0014/S0037.

3. The OTV camera numbering scheme for PAD A/B is 0XX/1XX.

4. Task Team Leader assignment: NASA PH-H is TTL for L-20 Hour Walkdown, Final Inspection, and Post Launch/Drain Walkdown. ETM is TTL for all other operations.

5. From time stable replenish mode starts until start of final SCAN, scanning with individual cameras should be performed approximately once per hour.

6. Cameras 061/161, 063/163, and 070/170 may be released to NASA select with CICE concurrence.

7. All personnel participating in final inspection and post drain walkdown shall be current in following training:

   A. Emergency PAD egress

   B. Fire fighting

   C. ELSA

8. Milestones:

   A. MLP portion of post launch walkdown commences at approximately T + 1 hours.

   B. PAD acreage portion of the post launch walkdown commences at approximately T + 2 hours. (may be deferred until preferred daylight hours.)

   C. Post drain walkdown commences at approximately T + 4 hours after drain initiated (typically 1 1/2 hours after LH_2/LO_2 low level sensors dry).

9. Hands-on investigation required for all ET-TPS defects suspected of violating NSTS 08303 ice/debris inspection criteria.

10. From time launch scrub is declared until 1.5 hours past time LH_2/LO_2 low level sensors read dry, OTV camera scanning shall be performed approximately once per hour.

11. OTV cameras 004/104, 009/109, 013/113, 033/133, 042/142, 054/154, 055/155, 056/156, 060/160, 061/161, 062/162, 063/163, 064/164, 065/165, 066/166, 067/167, 068/168, 069/169, 070/170, and 071/171 shall be used to monitor LO_2/LH_2 tank drain operations.

12. Excessive vapors are defined as being more severe than that described in NSTS 08303 - Ice/Debris Inspection Criteria or NSTS 16007 - Launch Commit Criteria - Hazardous Gas Subsystem.

13. Quality coverage is not required for performance of this OMI. Ref SFOC-GO0007, Ice and Debris Team Operations are exempt from quality coverage. The ROR (CTIF) performs the CMQC function for all non-hazardous operations.

14. Personnel using Sony DKC-ID1 camera shall verify lithium ion battery is securely locked in the bayonet fitting and the lithium button battery door is securely locked and taped in place.

15. Verify camera flash is deactivated.

16. Personnel using Kodak DC 50/120 camera shall verify alkaline batteries are properly installed.

17. Personnel using digital cameras shall not operate in H_2 leak or O_2 rich environment (23 percent or greater).

18. Personnel using the Sony MVC-FD91 camera shall verify the lithium ion battery is securely locked and the battery door is locked closed. Personnel shall verify that both battery doors (lithium ion and lithium button) are closed and taped shut.

19. Personnel shall verify that cameras and equipment are securely tethered when at the PAD while the SSV is present.

1.3 Operations List

Operation		Shop/ Cntl Rm Console	OPR	Haz (Y/N)	Duration (Hrs)
No.	Title				
10	Support Preparations	STM/ FR2	ETM	N	0.2
15	IR Camera Setup	PH-H/ NA	ETM	N	4.0
20	Ice Prediction Briefing	SE/ NA	ETM	N	0.5
30	Pre-launch Walkdown	SE/ NA	ETM	N	2.0
40	Ice Frost Debris Console Initial Configuration Setup	SE/ FR2	ETM	N	3.0
50	SSV Debris Assessment	SE/ FR2	ETM	N	18.0
60	Group 1 Monitoring LO2 Chill Down Thru T-0	SE/ FR2	ETM	N	15.0
70	Group 2 Monitoring - LH2 Chill Down Thru T-0	SE/ FR2	ETM	N	15.0
80	Final Inspection	SE/ FR2	ETM	Y	3.0
90	LO2/LH2 Drain Monitoring	SE/ FR2	ETM	N	4.0
100	Console Securing	SE/ FR2	ETM	N	0.5
110	Summary Tape	SE/ FR2	ETM	N	18.0
120	Post Drain Walkdown	SE/ NA	ETM	Y	2.0
130	Post Launch Walkdown	SE/ NA	ETM	Y	3.0
140	Film Review	SE/ NA	ETM	N	15.0
145	IR Camera Removal	PH-H/ NA	ETM	N	2.0
150	Final Report	SE/ NA	ETM	N	0.5

2.0 SAFETY INFORMATION

2.1 Hazards

Operation
1. Working at unprotected heights.
2. Walkdown at PAD while SSV is in stable replenish mode.

2.2 Safety Requirements

Operation
1. If lightning activity is forecast to be within 5 miles of launch PAD, CTC and SFOC safety shall implement provisions of adverse/severe weather and lightning policy contained in GSOP 5400 Ground Safety Operations Procedures.
2. There are no safing/shutdown or evacuation steps required in this OMI.
3. Hazardous operations within this subtask OMI will not be started until safety concurrence to proceed has been given per the integrated OMI controlling this subtask.

2.4 Reference Safety Documentation

Number	Rev	Title
KHB 1710.2	LI	KSC Safety Practices Handbook
GSOP 5400	LI	Ground Safety Operating Procedures

3.0 STAGING REQUIREMENTS

3.1 Referenced Engineering Documentation

3.1.2 Documents (Auto Build Section)

3.1 Referenced Engineering Documentation

3.1.2 Documents

OPERATION 120

Document No.	Rev	Title
NSTS 08303	(LI)	NSTS PROGRAM ICE/DEBRIS INSPECTION CRITERIA

3.2 Parts, Materials, Equipment, and Special Tools

3.2.5 Shop Support Materials

OPERATION 15

Part No./Find No.	Nomenclature	Qty	Unit
8305-00-519-3144	Rymple cloth	2	roll
6810-00-543-7915	Isopropyl alcohol	8	ounces

OPERATION 145

Part No./Find No.	Nomenclature	Qty	Unit
8305-00-519-3144	Rymple cloth	2	roll
6810-00-543-7915	Isopropyl alcohol	8	ounces
6505-00-133-8025	Petroleum Jelly, Vaseline (or equivalent)	1	tube/jar

3.2.8 Personal Protective Equipment

OPERATION 15	**Nomenclature**
	N-Dex nitril gloves
	chemical splash goggles
	face shield
OPERATION 30	**Nomenclature**
	safety harness
	lanyard
OPERATION 80	**Nomenclature**
	safety harness
	lanyard
	Nomex coveralls with gloves and hoods
	ELSA
OPERATION 120	**Nomenclature**
	safety harness
	lanyard
	hardhats
	flame retardant coveralls
OPERATION 130	**Nomenclature**
	safety harness
	lanyard
	hardhats
	flame retardant coveralls
OPERATION 145	**Nomenclature**
	N-Dex nitril gloves
	chemical splash goggles
	face shield

4.0 PLANNING REQUIREMENTS

OIR Required Yes [ ], No [X]

4.3 LPS Requirements

4.3.1 Computer Systems

PC GOAL
CCMS Configuration
CDS
CMS

4.4 Support Services, Commodities, and Equipment

4.4.2 Communications

(Per controlling OMI S0007, S0014 or S0037 unless specified otherwise)

4.4.3 OTV

(Per controlling OMI S0007, S0014 or S0037 unless specified otherwise)

OTV Cameras required: 004/104, 009/109, 013/113, 033/133, 042/142, 054/154, 055/155, 056/156, 060/160, 061/161, 062/162, 063/163, 064/164, 065/165, 066/166, 067/167, 068/168, 069/169, 070/170, and 071/171

OTV Cameras to be recorded: 004/104, 009/109, 013/113, 033/133, 042/142, 054/154, 055/155, 056/156, 060/160, 061/161, 062/162, 063/163, 064/164, 065/165, 066/166, 067/167, 068/168, 069/169, 070/170, and 071/171

4.4.4 Countdown Display/Status

Display Required	Bldg	Room	Operation Time
Timing	LCC	FR2	Duration of Test
Countdown and GMT	LCC	FR2	Duration of Test

4.4.8 Services

SGS Organization	Operation/Step
LS	10-2

COMM Organization	Operation/Step
COMM	10-1
COMM	50-6
COMM	60-1
COMM	60-3
COMM	60-6
COMM	60-9
COMM	60-11
COMM	70-1
COMM	70-3
COMM	70-6
COMM	70-9
COMM	70-10
COMM	70-11
COMM	90-2
COMM	90-4
COMM	100-2

4.4.12 Propellants, Gases and Chemicals

Commodity	Spec No.	Quantity	Rcvr	Location	Minimum Press	Delivery Time
GN_2	SES-0073 -6.3-5	Min 750 Cu ft	PH-H 861-3645	Pad 39B Camera Site 2	3000 PSI	1 week prior to T-0

5.0 CONFIGURATION ACCOUNTING AND VERIFICATION

5.1 Specific OMRS Requirements Satisfied by this TOP

OMRS NO.	NOMENCLATURE/ EFFECTIVITY	SEQ-STEP (CAP)
S00E00.021	ET TPS MON DURING DETANK	90-005
	L01 TAF;C	
S00E00.031	POST DETANK ET TPS INSPECT	120-002
	L01 TAF;C	
S00FA0.900	PRELAUNCH WEATHER BRIEFING (L-1 DAY)	20-001
	L01 VAF1-90	
S00FB0.005	ET TPS SURFACE MONITORING	50-024
(1)	L01 T23,27-29,31-999	
S00FB0.350	MONITOR GO2 VENT HOOD	50-026
(1)	L01 VAF1-90	
S00FB0.360	MONITOR ET/ORB MPS FOR LEAKAGE	50-024
(1)	L01 VAF1-90	
S00L00.150	HIGH WIND ET NOSE INSPECTION	50-022
	L01 SAF;C	
S00U00.010	POST LAUNCH SHUTTLE/PAD AREA INSPECTION	130-002
(1)	L01 SAF1-999	
S00U00.011	ENGR REVIEW & ANALYSIS OF LAUNCH FILM	140-001
(1)	L01 SAF1-999	
S00U00.020-A	ENGINEERING PAD INSPECTION	80-002
(1)	L01 SAF1-999	
S00U00.020-C	INSPECT ORBITER AFT ENGINE	80-002
(1)	L01 SAF1-999	
S00U00.020-D	INFRARED SURVEILLANCE	80-002
(1)	L01 SAF1-999	
S00U00.030	PRELAUNCH SHUTTLE/PAD AREA INSPECTION	30-001
(1)	L01 SAF1-999	

5.5 List of References

OPERATION 20

Reference No.	Rev	Title
NSTS 16007	(LI)	NSTS Program Launch Commit Criteria - Hazardous Gas Subsystem and Appendix F

OPERATION 30

Reference No.	Rev	Title
80901019010	(LI)	ET Post Build Acceptance and In-Process Rework Requirements Manual - Offsite

OPERATION 40

Reference No.	Rev	Title
79K24576	(LI)	OTV System Installation, LC 39, Pad A
79K24522	(LI)	OTV System Installation, LC 39, Pad B

OPERATION 50

Reference No.	Rev	Title
SPI SP-519	(LI)	OMI and OM Implementation
SFOC GO0007	(LI)	Quality Planning Requirements Document (QPRD)

OPERATION 10 Support Preparations

Shop: **STM**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **0.2**

10-1 STM JYVO 138

Verify PAD OTV system is configured to support S6444 as scheduled.

Support: COMM

10-2 STM JSTC 111
JSTC *SCB 114

Verify eight 10-minute ELSA's available at complex J for use by Final Inspection Team (ref S0007/S0014/S0037).

Support: LS

10-3 STM TBC 136

Operation - Support Preparations complete.

*** End of Operation **10** ***

1-6-03

OPERATION 15 IR Camera Setup

Shop: **PH-H**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **4.0**

WARNING

Hard hats required on the Pad when SSV is not present.

CAUTION

Exercise care to avoid dropping equipment, fasteners, etc from RSS Roof to prevent damage to equipment or injury to personnel. All tools must be tethered.

NOTE

IR Camera installation at RSS Roof site may be not performed if IR Camera already installed or if technical concerns preclude such.

15-1 **Install** IR camera at RSS Roof Site as follows.

1. **Rotate** camera housing back cover to open position by removing bolts with flat washers (20 pl). **Retain** bolts/washers for reinstallation.

2. **Remove** camera housing front cover by removing fasteners (2 pl). **Reinstall** fasteners after cover removal. **Retain** cover for reinstallation after IR Camera Unit removal.

3. **Install** IR Camera Unit into camera housing. **Secure** IR Camera Unit in housing by locking spring pin at lower, left.

1-6-03

WARNING

Power cable is live. Care should be exercised when connecting power cable to avoid electric shock.

CAUTION

Do NOT allow opened back cover to exert undue force on cables once cables have been connected.

4. **Connect:**
   - OTV coaxial cable
   - Pan & tilt cable
   - Controller cable
   - Power cable

5. **Rotate** camera housing back cover into closed position. **Secure** back cover by installing bolts/flat washers (20 pl). **Tighten** bolts wrench tight.

1-6-03

WARNING

Isopropyl Alcohol is flammable and is a skin, eye and respiratory tract irritant that affects the central nervous system. Ensure adequate ventilation, avoid inhalation of vapors and do not use near heat, sparks or open flame. Skin contact may cause redness and pain eye contact will cause severe eye irritation and may result in permanent damage. Inhalation of vapors in high concentrations has a narcotic effect on the central nervous system. Personnel shall wear **N-Dex nitril gloves** and **chemical splash goggles** . When working at eye level or above wear a **face shield** over goggles.

WS002.a 05-22-01

6. **Clean** IR Camera Unit lens plate using (1) roll 8305-00-519-3144 Rymple cloth dampened with (4) ounces 6810-00-543-7915 Isopropyl alcohol .

7. **Perform** functional checkout of IR Camera Unit using local controller if required at Task Team Leader (TTL) discretion.

*ETC (1)

ET 05

Sub Step Not Performed: _____ 1/-23-02

NASA PH-H _____ Date _____

USA ETM _____ Date _____

ET 05

Not Performed: _____

1/-23-02

*0 VOID STAMP-
R Brewer ETM-SE
(ET-03) 1-21-03

ET 05

NOTE

IR Camera installation at Camera Site 2 may be not performed if IR Camera already installed or if technical concerns preclude such.

15-2 **Install** IR camera at Camera Site 2 as follows.

1. **Rotate** camera housing back cover to open position by removing eight ea bolts using Phillips screwdriver. **Retain** bolts/washers for reinstallation.

2. **Remove** camera housing front cover by removing securing bolt(s). **Reinstall** bolt(s) after cover removal. **Retain** cover for reinstallation after IR Camera Unit removal.

3. **Install** IR Camera Unit into camera housing. **Secure** IR Camera Unit in housing by tightening set screw(s) wrench tight at lower left/right.

WARNING

Power cable is live. Care should be exercised when connecting power cable to avoid electric shock.

4. **Connect:**
   - OTV coaxial cable
   - Pan & tilt cable
   - Controller cable (2 pl)
   - Power cable

5. **Rotate** camera housing back cover into closed position. **Secure** back cover by installing bolts (8 pl). **Tighten** bolts using Phillips screwdriver.

1-6-03

WARNING

Isopropyl Alcohol is flammable and is a skin, eye and respiratory tract irritant that affects the central nervous system. Ensure adequate ventilation, avoid inhalation of vapors and do not use near heat, sparks or open flame. Skin contact may cause redness and pain eye contact will cause severe eye irritation and may result in permanent damage. Inhalation of vapors in high concentrations has a narcotic effect on the central nervous system. Personnel shall wear **N-Dex nitril gloves** and **chemical splash goggles** . When working at eye level or above wear a **face shield** over goggles.

WS002.a 05-22-01

6. **Clean** IR Camera Unit lens plate using (1) roll 8305-00-519-3144 Rymple cloth dampened with (4) ounces 6810-00-543-7915 Isopropyl alcohol .

7. **Perform** functional checkout of IR Camera Unit using local controller if required at Task Team Leader (TTL) discretion.

*
11-23-02
ET 05

Sub Step Not Performed:

NASA PH-H _____ Date _____

USA ETM _____ Date _____

ET 05
Not Performed: _____
11-23-02

*** End of Operation 15 ***

*ENTERED IN ERROR
VOID STAMP
RBrewer 1/21/03
ET-05-

1-6-03
ET 05

E. Cary Ralston
Vice President and
RSRM Program Manager

ATK Thiokol Propulsion
P.O. Box 707, M/S E00
Brigham City, UT 84302-0707

Tel 435 863-2258
Fax 435 863-8755
cary.ralston@atk.com

November 21, 2002
E600-CY02-410

George C. Marshall Space Flight Center
National Aeronautics & Space Administration
Marshall Space Flight Center, AL 35812

Attention Mr. M. U. Rudolphi, MP51

Gentlemen:

Subject: RSRM-86/STS-113 Transmittal of L-24 Hour PMBT Prediction

This letter officially transmits the L-24 hour propellant mean bulk temperature (PMBT) predicted for STS-113, scheduled for launch on November 22, 2002. The PMBT at the time of launch is predicted to be 72°F which is within the 44° to 86°F requirement. This PMBT prediction is also valid for November 23, 2002.

Very truly yours,

Joni Endicott for
E. C. Ralston

ECR:JBE/mp

cc: T. Boardman, L00
J. Burn, LD0
S. Eden, E68
J. Endicott, E68
K. Foulger, E62
S. Henderson, LF0
M. Kahn, A10
C. Ralston, E00
R. Roth, Thiokol/MSFC
D. Ruddell, E68
D. Burton, K68
S. Cash, MP51
T. Shaffner, Thiokol/KSC
B. St. Aubin, Thiokol/KSC
P. Teehan, KSC-SK
D. Wood, MP51

OPERATION 20 Ice Prediction Briefing

Shop: **SE**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **0.5**

NOTE

Ref: NSTS 16007 (LI) NSTS Program Launch Commit Criteria - Hazardous Gas Subsystem and Appendix F defines the ET No-Ice Zone.

20-1 **CICE**

Conduct L-1 day ice prediction briefing with launch director.

PH-H Signature Amanda Lin 11/23/02

OMRSD S00FA0.900 WA 141 USA

20-2 Operation - Ice Prediction Briefing complete.

*** End of Operation **20** ***

OPERATION 30 Pre-launch Walkdown

Shop: **SE**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **PAD**
Hazard (Y/N): **N**
Duration (Hrs): **2.0**

WARNING

Personnel working at heights greater than 4 feet and within 6 feet of an unguarded edge shall wear a **safety harness** with a **lanyard** secured to an approved tie off point, substantial structural member (no handrails) or a properly installed life line.

NOTE

This operation is performed at approximately L-20 hours. When this operation is performed in support of a 24 hour scrub turnaround, the preceding launch scrub post drain walkdown and this pre-launch walkdown may be performed concurrently.

Inspections may also be performed from the RSS, GO_2 Vent Arm (GVA), -Y OWP, or +Y OWP if still extended and accessible.

Ref: 80901019010 (LI) ET Post Build Acceptance and In-Process Rework Requirements Manual - Offsite

NASA ET Mechanical Engineer (PH-H) or designee shall function as team leader. Following personnel are optional walkdown participants.

NASA Engr	(4)
SFOC Engr	(2)
LMSSC - LSS	(1)
Boeing - LSS	(1)
SRB ELE	(1)
Thiokol - LSS	(1)

30-1 Debris inspection team **perform** walkdown of SSV and MLP per following:

1. Team leader **verify** S6444 pre-test briefing complete.

2. **Assemble** following essential personnel

   NASA PH-H Engineering - 1
   SFOC ETM Engineering - 1

3. **Inspect** following areas (as a minimum) from the MLP, RSS and FSS to identify/ resolve potential debris sources.

   Areas to be inspected

   A. Launch vehicle external surfaces

   - Orbiter
   - SRB's
   - External Tank

   B. MLP surfaces

   - LH and RH SRB holddown posts
   - Deck including deck bolts, fixtures, and edge gutters
   - SSME LH and RH SRB exhaust openings, and sound suppression (SS) troughs
   - TSM's and camera housings

4. Ref Table 30-1, **document** and SIM Photograph SSV and Launch PAD Configuration.

   Description: Pre launch walkdown.

OMRSD S00U00.030-1 USA VM 141

SPC No. ⊛ 51120

⊛ See RUN2 POST DRAIN WALKDOWN

Disc/Frame Nos: 1-41

11-23-02

30-2 **Record** all facility discrepancies in S0007. Submit copy to PAD leader and **notify** TBC/CTC. **Verify** no constraints to continue. **Forward** description(s) of debris found to SFOC QC for entry into Processing Debris / FOD Database.

PH-H A. Ochs Date 11-23-02

FOR

ETM Bill Richards Date 11-23-02
0845 HRS

30-3 Operation - Pre-launch Walkdown complete.

1-6-03

Table 30-1 Photo Requirements for SSV and Launch Pad Configuration			
	Photos from MLP		
Photo	**Camera Orientation**	**Lens**	**Notes**
ET -Z	Vertical	28 mm	
Aft Dome	Horizontal	28 mm	
Aft Dome	Horizontal	35-70 mm	
LH SRB from North	Horizontal	35-70 mm	All water troughs in view
LH SRB from North	Vertical	35-70 mm	3-4 water troughs in view
LH SRB from East	Vertical	35-70 mm	
RH SRB from North	Horizontal	35-70 mm	All water troughs in view
RH SRB from North	Vertical	35-70 mm	3-4 water troughs in view
RH SRB from West	Vertical	35-70 mm	
SRB Heater Elec T-0	Horizontal	35-70 mm	Foam intrusion; May need flash
North HDP	Vertical	35-70 mm	Representative view
South HDP	Vertical	35-70 mm	Representative view
TSM T-0 LH_2	Vertical	35-70 mm	Flash needed
TSM T-0 LO_2	Vertical	35-70 mm	Flash needed
Orbiter Left & Right Wing	Vertical	35-70 mm	From below ET (1 Photo each wing)

135 Ft Level Photos

Photo	Camera Orientation	Lens	Notes
LO_2 UMB	Vertical	35-70 mm	From OWP usually during T5401
LH_2 UMB	Vertical	35-70 mm	From OWP usually during T5401

215 Ft Level Photos

Photo	Camera Orientation	Lens	Notes
ET surfaces from FSS	Vertical	35-70 mm	
LH SRB Frustrum and FWD skirt	Vertical	35-70 mm	
RH SRB Frustrum and FWD skirt	Vertical	35-70 mm	
Jack Pad C/O's	Horizontal	35-70 mm	Flash needed (1 each C/O)
LO_2 Ogive Cable Tray	Vertical	35-70 mm	From RSS roof

255 Ft Level Photos

Photo	Camera Orientation	Lens	Notes
ET surfaces with GO_2 vent ducts in view	Vertical	35-70 mm	
GO_2 vent ducts	Horizontal	250 mm	

***** End of Table 30-2 Photo Requirements for SSV and Launch Pad Configuration**

*** End of Operation **30** ***

OPERATION 40 Ice Frost Debris Console Initial Configuration Setup

Shop: **SE**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **3.0**

> **NOTE**
> The next step sets up the photo processing laptop for use in the Firing Room. This is not a constraint to set up of the console or to final inspection team operations. Network or equipment failures on the photo processing machine shall be annotated below.

40-1 **Configure** computer to perform image processing, analysis, and recording:

1. **Connect** following equipment at Ice/Frost console:
   - power cable to computer
   - "Dazzle" capture card to laptop parallel port
   - "Y" adapter to laptop PS2 port
   - keyboard to keyboard port on "Y" adapter
   - mouse to mouse port on "Y" adapter
   - monitor to laptop
2. **Insert** Xircon Network Card into Personal Computer PCMCIA port.
3. **Connect** ethernet (gray) cord to Xircon Network Card.
4. **Remove** terminator from video cable.
5. **Plug** BNC-to-RCA adapter into end of video cable.
6. **Plug** video cable into "Dazzle" DVC "video in".
7. **Power-up** Trouble Console VCR.

8. **Log-on** to KSC Ground Ops. **Click-on** Start/Programs/Dazzle.

9. **Confirm** above equipment as operational and record results.

Results OPERATIONAL

ETM ME J8 11-23-02

NOTE

The next step verifies the setup of the infrared scanners. This is not a constraint to set up of the ice console. IR scanner condition shall be annotated below.

40-2 **Verify** IR scanner operation condition, annotate below.

RSS: OPERATIONAL

CS 2: OPERATIONAL

NOTE

The next step verifies the operation of console monitors in the Firing Room. This is not a constraint to set up of the console or to final inspection team operations. Equipment condition shall be annotated below.

40-3 **Verify** console condition by powering on monitors and tape recorders.

Monitors: ME 08 11-23-02

Tape recorders: ME 08 11-23-02

ME 1-1-03

NOTE

ET OTV pre-mapping/initial position of cameras may be performed in random order.

Ref: 79K24576 (LI) OTV System Installation, LC 39, Pad A and
Ref: 79K24522 (LI) OTV System Installation. LC 39. Pad B define OTV camera locations.

FOV designates field-of view. RSS and -Y OWP must be retracted for completion of pre-mapping.

Pre-mapping steps/substeps in the remainder of this operation need not be performed if supporting a scrub turnaround and if performed during a previous run.

It is preferred to record all pre-mapping scanning on a single tape. However, multiple tapes may be used when lighting/ launch countdown constraints necessitate such.

40-4 CVM1 JTV1 223

Perform OTV pre-mapping of External Tank exterior surfaces using OTV Cameras 004/104, 009/109, 013/113, 033/133, 042/142, 054/154, 055/155, 056/156, 060/160, 061/161, 062/162, 063/163, 064/164, 065/165, 066/166, and 067/167 as follows:

- **Insert** designated pre-map tape into trouble console VCR.
- **Punch-up** camera number on trouble monitor.
- **Start** recording on pre-map tape. **Record** start time (GMT).
- **Scan** from top-to-bottom, left-to-right and right-to-left at approximately full zoom-in.
- **Stop** recording on pre-map tape. **Record** stop time (GMT).
- **Record** data in Table 40-1.
- **Repeat** with each OTV camera listed until each has been used to scan the External Tank.
- **Remove** pre-map tape from trouble console VCR.

ETM N/A Date N/A

Not Performed: ME 08 11-23-02

40-5 CVM1 JTV1 223

Position OTV Cameras 004/104, 009/109, 013/113, 033/133, 042/142, 054/154, 055/155, 056/156, 060/160, 061/161, 062/162, 063/163, 064/164, 065/165, 066/166, 067/167, 070/170, and 071/171 to initial positions as defined in Table 40-2.

ETM N/A Date N/A

Not Performed: ME 08 11-23-02

11-07

Table 40-1 ET Pre-Mapping Data Tape # _____

OTV Camera	Start Time (GMT)	Stop Time (GMT)
004 / 104		
009 / 109		
013 / 113		
033 / 133		
042 / 142		
054 / 154		
055 / 155		
056 / 156		
060 / 160		
061 / 161		
062 / 162		
063 / 163		
064 / 164	N	A
065 / 165		
066 / 166		
067 / 167		

Notes: _____

Table 40-2 OTV Camera Initial Positions	
OTV Camera	**Initial Position**
004 / 104	FOV centered on GUCP
009 / 109	FOV on LH_2 Umbilical including ET/Orbiter interface. Vary close-up and wide angle views with 063/163 and 064/164.
013 / 113	Full zoom in. View SW GO_2 Vent Louver area.
033 / 133	FOV perpendicular to ET and with LO_2-to-Intertank splice at frame top and LH_2-to-Intertank splice at frame bottom. Then tilt down until XT2058 is in frame center.
042 / 142	FOV centered on Orbiter Access Arm-to-Orbiter interface.
054 / 154	FOV to encompass approximately 3 feet forward of XT2058 to 2 feet aft of XT2058. Orbiter wing and SRB should be in view at frame left.
055 / 155	Set FOV on north bridge LH_2 pipeline flange.
056 / 156	FOV with LH_2 Aft Dome in frame bottom and XT2058 in view at frame top.
060 / 160	Full zoom in. View SW GO_2 Vent Louver area.
061 / 161	Full zoom-in. Adjust FOV until ET LO_2-to-Intertank splice is centered vertically and view is perpendicular to ET. Pan right until edge of the ET comes into view. Note: LO_2 Tank may pass out-of-view.
062 / 162	Full zoom in. View NW GO_2 Vent Louver area.
063 / 163	FOV on LH_2 Umbilical including ET/Orbiter interface. Vary close-up and wide angle views with 009/109 and 064/164.
064 / 164	FOV on LH_2 Umbilical including ET/Orbiter interface. Vary close-up and wide angle views with 009/109 and 063/163.
065 / 165	Full zoom out. Set FOV on aft part of ET with frame bottom approximately 2 feet below LH_2 Aft Dome.
066 / 166	FOV perpendicular to ET with LO_2-to-Intertank splice at frame top. Then tilt down until Orbiter RH Wing/SRB intersection is in frame lower right.
067 / 167	Set FOV with LH_2 Aft Dome toward frame bottom and 2nd black ring of SRB in view.
070 / 170 071 / 171	Select down wind camera of these two as wide angle view of the SSV. Set up wind camera for close-up view of SSME's.

1-6-07

40-6 Operation - Ice Frost Debris Console Initial Configuration Setup complete.

ETM ME OB Date 11-23-02

*** End of Operation 40 ***

OPERATION 50 SSV Debris Assessment

Shop: **SE**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **18.0**

> **NOTE**
> Steps in this operation are contingent upon progression of launch countdown operations and may not be performed if countdown is terminated.

Entire Operation Not Performed: N/A

> **NOTE**
> Until otherwise indicated, all times are referenced to S0007, S0014 or S0037 timelines.
>
> No operations/steps within this subtask OMI may be performed as a stand-alone procedure. This OMI may only be performed as a subtask to S0007/S0014/S0037.

> **NOTE**
> Ref: SPI SP-519 (LI) OMI and OM Implementation and Ref: SFOC GO0007 (LI) Quality Planning Requirements Document (QPRD) , following step complies with requirements for ROR-as-CMQC function.

50-1

CTIF TBC
TBC CMQC 136

Notify TBC that CTIF will perform the CMQC function for STS 113, S6444 run 3. Request TBC notify CMQC that the ROR-as-CMQC option will be exercised for STS 113, S6444 run 3.

50-2

CTC	TBC	232
TBC	CTIF	136

Perform OTV and ice/frost monitoring area setups.

ME 08

ETM_____ Date 11-23-02

50-3

CTIF	TBC	136
TBC	CTC	
CTC	STM	232

Verify Operation 10- Support Preparations complete.

ME 08

ETM_____ Date 11-23-02

50-4

CTIF

Verify Operation 20 - Ice Prediction Briefing and Operation 30- Pre-launch Walkdown complete.

ME 08

ETM_____ Date 11-23-02

50-5

CTIF	**CVM1**	**222**
	CVM1	**222**

Verify:

- All OTV cameras are on, tapes in recorder, and ready to commence OTV scanning, monitoring, and recording.
- Trouble tape recorder is ready.
- Ice Frost Debris Console Initial Configuration Setup complete.

ME 08

ETM_____ Date 11-23-02

50-6

CTIF	**CICE**	**222**
	CVM1	
	CVM2	
	CIPC	
CTIF	**JYVR**	**138**
CVM1	**JTV1**	**223**
CVM2	**JTV2**	**225**

All personnel participating in OTV operations **report** test ready status.

ME 08

ETM_____ Date 11-23-02

Support: COMM

50-7

CTIF TBC 136
TBC CTC 232

Ice Frost Console Area Setups for OTV scanning complete.
Report readiness.

ETM ME 08 Date 11-23-02

Not Performed: N/A

50-8

CTIF CVM1 222

From start of LO_2 chilldown until seal deflation/GO_2 vent hood retraction, **monitor** the +Y/-Y GO_2 vent seal-to-ET interface for seal fretting and continuous GO_2 escape.

OMRS S00FB0.350-1

ETM ME 08 Date 11-23-02

Not Performed: N/A

NOTE

GO_2 vent seal fretting could induce damage to ET SOFI. Continuous GO_2 venting could result in formation of ice in the no ice zone (ref NSTS 16007). Ultimate decision to lift the vent hood rests with CMEC.

50-9

CTIF TBC 136
CMEC

If +Y/-Y GO_2 vent seal fretting or continuous GO_2 escape detected from start of LO_2 chilldown until seal deflation, **notify** CMEC for GO_2 vent hood removal.

ETM N/A Date N/A

Not Performed: ME 08 11-23-02

50-10

CTIF CIPC 222

Monitor wind speed and direction from start of LO_2/LH_2 chill down through launch/scrub. CIPC **notify** CTIF if winds measured at 38 knots or greater from North +/-30 degrees as measured at 60 feet.

ETM ME 08 Date 11-23-02

Not Performed: N/A

1 1 02

NOTE

Excessive vapors are defined as being more severe than those described in NSTS 08303 (LI) NSTS Program Ice/Debris Inspection Citeria or NSTS 16007 (LI) NSTS Program Launch Commit Criteria - Hazardous Gas Subsystem.

50-11

CTIF CVM1 222
CVM2

From start of LO_2/LH_2 loading until Prepressurization (LO_2 at T-2M55s and LH_2 at T-1M57s):

1. **Monitor** following ET-Orbiter MPS areas for leakage:
   - LO_2 Feedline (portion external to the Intertank)
   - LH_2 Feedline
   - LH_2 Recirculation Line
   - LH_2 Aft Dome Manhole Cover(s)
   - ET-Orbiter LO_2/LH_2 Umbilical Disconnects
   - LH_2 T-0 Umbilical
   - LO_2 T-0 Umbilical

2. **Verify** no visible cryogenic liquid of excessive vapors.

OMRS S00FB0.360-1

ETM ME 08 Date 11-23-02

Not Performed: N/A

50-12

CTIF CVM1 222
CVM2

Monitor and **videotape** following ET TPS surface areas and GO_2 Vent Area during LO_2/LH_2 loading through Prepressurization (LO_2 at T-2M55s and LH_2 at T-1M57s):

- LH_2 Aft Dome
- LH_2 Barrel
- Intertank (external)
- LO_2 Tank
- GO_2 Vent Area
- Protuberances

OMRS S00FB0.005-1

ETM ET 05 Date 11-23-02

Not Performed: N/A

50-13

CTIF CVM1 222

Perform Operation 60 - Group 1 Monitoring.

ETM ME 08 Date 11-23-02

Not Performed: N/A

50-14

CTIF CVM2 222

Perform Operation 70 - Group 2 Monitoring.

ME 08

ETM_____ Date 11-23-02

Not Performed: N/A

50-15

CTIF CVM2 222

Once per hour minimum, after start of LO_2/LH_2 (until LO_2/LH_2 low level sensors read dry), **scan** LO_2 feed line brackets and flange closeouts per Table 50-1.

ME 08

ETM_____ Date 11-23-02

Not Performed: N/A

50-16

CTIF CICE 222

As count proceeds, for concerns/ observations identified:

1. **Record** observation/concern on trouble tape per Table 50-1.

2. **Document** observed condition on Table 50-2, Observation Worksheet.

ETM ME 08 Date 11-23-02

Not Performed: N/A

50-17

TBC CTIF 136
CTIF CICE 222

Perform Operation 80 - Final Inspection when called by S0007/S0014/S0037.

ETM ME 08 Date 11-23-02

Not Performed: N/A

NOTE
Final SSV scan typically commences at L-2 hours.

50-18

CTIF CVM1 222
CVM2

Perform final SSV scan.

ETM Mark Wilson Date 11/23/02

Not Performed: NA

50-19

CTIF CVM1 222
CVM2

At start of T-9 minute hold, **configure** OTV cameras for terminal count.

ETM ET/OS Date 11-23-02

Not Performed: NA

50-20

CTIF 222

Start continuous recording per Table 50-1 at pick-up of T-9 Minute count including following events:

- T-7M30S OAA retraction on camera OTV 008/108 or 042/142.
- T-3M55S Orbiter elevon movement on OTV 009/109, 054/154, 063/163 064/164.
- T-2M30S GOX Vent Seal retraction, +Y / -Y GOX Vent Louvers, and GOX Vent Seal Footprints on OTV 013/113, 060/160, 061/161, 062/162, 068/168, and 069/169.
- T-1M00S through last view of vehicle during ascent on NASA Select (channel 179).

ETM_____ Date 11-23-02

Not Performed: N/A

NOTE

Ref: NSTS 16007 (LI) NSTS Program Launch Commit Criteria - Hazardous Gas Subsystem Appendix F - Ice Launch Commit Criteria defines "No-Go Conditions."

50-21

CICE CTIF 222

Verify there are no Ice Launch Commit Criteria "No-Go Conditions" being violated.

ETM Mark Wollam Date 11/23/02

MARK WOLLAM (MW)

50-22

If winds are from the north (+/-30 degrees) and are 38 knots (peak as measured at 60 feet above ground) or greater:

1. **Monitor/videotape** nose cone area during high winds.

2. **Verify:**

   A. No ice formation on the +Y and -Y GO_2 vent seal footprint areas.

   B. No damage to the ET TPS at the +Y and -Y GO_2 vent seal footprint areas.

   C. No damage to the +Y and -Y GO_2 vent seals themselves.

   D. No evidence of GO_2 leakage from +Y/-Y GO_2 vent seals to ET interface.

USA VM OTS

OMRSD S00L00.150

ETM NA Date 11/23/02

Not Performed: 9/19/97

11-23-02

50-23

CTIF

Verify launch or launch scrub (drain back). **Record** data.

Launch ✓ Scrub N/A

Date 11-23-02 Time 00:49 GMT

Scrub at T- N/A

ETM ET 05 Date 11-23-02

50-24

CTIF

ET-Orbiter MPS monitoring for leakage and ET TPS Surface Areas and GO_2 Vent Area monitoring/recording for launch complete.

OMRSD S00FB0.005-1
OMRSD S00FB0.360-1 USA VM 141

ETM ET 05 Date 11-23-02

Not Performed: N/A

11-23-02

NOTE

When completely filled and drain is initiated, it takes approximately 1 hour until the LH_2 tank low level sensors read dry, and approximately 1.5 hours until the LO_2 tank low level sensors read dry.

50-25

CTIF CVM1 222
CVM2

If launch scrubbed (or drain back declared) after start of LO_2/LH_2 slow fill mode:

- **Perform** Operation 90 - LO_2/LH_2 Drain Monitoring.
- **Record** observations/concerns on trouble tape per Table 50-1.
- **Document** all observations/concerns on Table 50-2 Observation Worksheet.

ETM N/A Date _____

Not Performed: ET 03

11-23-02

50-26 CTIF

GO_2 Vent seal to ET interface monitoring for seal fretting and continuous GO_2 escape complete.

USA VM 141 OMRSD S00FB0.350-1

ETM N/A Date _____

Not Performed: ET 03

11-23-02

50-27

CTIF CVM1 222
CVM2

Terminate scanning operations.

ETM ET/12 Date 11-23-02

50-28

CTIF CVM1 222
CVM2

Perform Operation 100 - Console Securing.

ETM ET/05 Date 11-23-02

50-29

CTIF

If LO_2/LH_2 tanking started, **perform** Operation 110 - Summary Tape.

ETM N/A Date _____

Not Performed: ET/05
11-23-02

ET

NOTE
Following step may be not performed at CTIF discretion.

50-30 **CTIF** **TBC** **136**
TBC **STM**

If Post Drain Walkdown to occur at night, **request** PAD xenon lighting be maintained/activated for duration of walkdown.

Not Performed: _____
11-23-02

NOTE
Post drain walkdown typically commences approximately 1.5 hours after LH_2/LO_2 low level sensors read dry.

50-31

CTIF

If launch scrubbed after start of LO_2/LH_2 tanking, **perform** Operation 120 - Post-Drain Walkdown.

ETM_____ N/A Date_____

Not Performed: _____
11-23-02

50-32

CTIF

If launch occurred, **perform** Operation 130 - Post launch Walkdown.

ETM_____ Date 11-23-02

Not Performed: N/A

50-33

CTIF

If launch occurred, **perform** Operation 140 - Film Review.

ETM ET/05 Date 11/25/02

Not Performed: N/A

50-34

SSV Debris Assessment complete.

Table 50-1 Observation Documentation Procedure

1.	CTIF	CVM1 CVM2	222	Locate anomaly/concern on pertinent OTV(s)
2.	CTIF			Punch-up pertinent OTV on trouble monitor. Update trouble tape log in table below.
3.	CTIF			Start the trouble tape.

NOTE

Trouble tape shall be allowed to run until sufficient OTV documentation of observation/concern has been made. OK to change OTV's while trouble tape is running.

4	CTIF	After observation/concern has been documented on the trouble tape, stop the trouble tape. Update trouble tape log below.

TROUBLE TAPE LOG

Trouble Tape No.	Start Time (GMT)	Stop Time (GMT)	OTV	Description
01	1628	1629	0054	LO2 F/L Scan
01	1730	1735	054	LO2 F/L SCAN
01	1749	1750	063	-Y LONGERON C/O - 1 SMALL FROST SI IN CLOT
01	1758	1803	056	LIQUID/CONDENSATE DRIPPING FROM GUCA
01	1816	1817	063	-Y RAPID RAMP OUTBOARD BONDLINE — FROST U VAPOR
01	1830	1832	054	LO2 F/L Scan
01	1928	1931	054	LO2 F/L SCAN
01	2031	2033	054	LO2 F/L Scan
01	2131	2133	054	LO2 F/L Scan
01	2235	2238	054	LO2 F/L Scan

TROUBLE TAPE LOG

Table 50-1 Observation Documentation Procedure

Trouble Tape No.	Start Time (GMT)	Stop Time (GMT)	OTV	Description
01	2240	2241	054	ET-SRB Cable Tray, Frost/Ball
01	2349	2353	054	F/L SCAN
01	2354	2355	063	-Y BI/POD AREA

*** End of Table 50-1 Observation Documentation Procedure ***

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. 001

Observed By: R. Brewer

Date 11/23/02 Time 18:52 GMT 23:52

Camera No. (or Walkdown) 063

Description:

-Y BIPOD Closeout AREAS HAS BOND LINE ~~SEPARATION~~ (1) AND SEVERAL THERMAL STREAKS.

Acceptance Rationale (or IPR/PR No.):

ACCEPTABLE PER NSTS 8303 - CONDITION(S) HAS BEEN SEEN AND ACCEPTED ON PREVIOUS MISSIONS - REF PHOTO 2.2.4, PAGE 2-27

ET/05 (1)

11-23-02

CICE [signature] A. Ochs Date 11/23/02

CTIF [signature] MULLINS Date 11/23/02

11-23-

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. _____

Observed By: _____

Date _____ Time _____ GMT _____

Camera No. (or Walkdown) _____

Description:

_____

_____

_____

_____

Acceptance Rationale (or IPR/PR No.):

N A

_____

_____

_____

_____

CICE _____ Date _____

CTIF _____ Date _____

1-6-0

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. _____

Observed By: _____

Date _____ Time _____ GMT _____

Camera No. (or Walkdown) _____

Description:

_____

_____

_____

_____

Acceptance Rationale (or IPR/PR No.):

N A

_____

_____

_____

_____

CICE _____ Date _____

CTIF _____ Date _____

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. _____

Observed By: _____

Date _____ Time _____ GMT _____

Camera No. (or Walkdown) _____

Description:

_____

_____

_____

_____

N A

Acceptance Rationale (or IPR/PR No.):

_____

_____

_____

_____

CICE _____ Date _____

CTIF _____ Date _____

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. _____

Observed By: _____

Date _____ Time _____ GMT _____

Camera No. (or Walkdown) _____

Description:

_____

_____

_____

_____

Acceptance Rationale (or IPR/PR No.):

_____

_____

_____

_____

CICE _____ Date _____

CTIF _____ Date _____

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. _____

Observed By: _____

Date _____ Time _____ GMT _____

Camera No. (or Walkdown) _____

Description:

_____

_____

_____

N/A

Acceptance Rationale (or IPR/PR No.):

_____

_____

_____

_____

CICE _____ Date _____

CTIF _____ Date _____

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. _____

Observed By: _____

Date _____ Time _____ GMT _____

Camera No. (or Walkdown) _____

Description:

_____

_____

_____

_____

Acceptance Rationale (or IPR/PR No.):

_____

_____

_____

_____

N A

CICE _____ Date _____

CTIF _____ Date _____

Table 50-2 Observation Worksheet

OBSERVATION DOCUMENTATION

Record following information for condition observed:

Observation No. _____

Observed By: _____

Date _____ Time _____ GMT _____

Camera No. (or Walkdown) _____

Description:

_____

_____

_____

_____

Acceptance Rationale (or IPR/PR No.): N A

_____

_____

_____

CICE _____ Date _____

CTIF _____ Date _____

***** End of Table 50-2 Observation Worksheet *****

*** End of Operation 50 ***

OPERATION 60 Group 1 Monitoring LO2 Chill Down Thru T-0

Shop: **SE**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **15.0**

NOTE

Do not perform this operation if launch scrub declared before LO_2 Chill Down commences.

Operation Not Performed: N/A

NOTE

This operation monitors LO_2 Ogive and Barrel and associated components/ areas from start of Chill Down through T-0 via OTV cameras 013/113, 060/160, 061/161, 062/162, 063/163 and 064/164.

OTV cameras 013/113 and/or 062/162 will view -Y GO_2 Vent Hood Seal at all times. At no time will both cameras be positioned away from the -Y GO_2 Vent Hood Seal.

OTV cameras 068/168 and 069/169 view SW and NE GO_2 Vent Areas respectively. These are fixed FOV cameras and do not have pan, tilt, etc. capability.

Steps in this operation are contingent upon progression of launch countdown operations and may be not performed if countdown is terminated.

LO_2 Chill Down To L-2 Hour Mark

60-1 CVM1 JYVR 138

At start of vehicle LO_2 Chill Down, **start** recorders for cameras 004/104, 013/113, 060/160, 061/161, 062/162, 063/163, 064/164, 068/168, and 069/169.

MS 17

ETM_____ Date 11/23/02

Support: COMM

60-2 **Record** LO_2 MPS Chill Down start date and time (GMT).

LO_2 MPS Chill Down Date 11/23/02 GMT Time 1545 GMT

MS 17

ETM_____ Date 11/23/02

60-3 CVM1 JTV1 223

From start of LO_2 Chill Down until start of LO_2 Fast Fill on OTV cameras 004/104, 013/113, 060/160, 061/161, 062/162, 063/163, 064/164, 068/168, and 069/169 **monitor/videotape** ET-TPS surfaces. No cryogenic liquid or excessive vapors allowed.

MS 17

ETM_____ Date 11/23/02

Support: COMM

Not Performed: N/A

60-4 **Record** LO_2 Slow Fill start date and time (GMT).

LO_2 Slow Fill Date 11/23/02 GMT Time 1626 GMT

ETM MS 17 Date 11/23/02

Not Performed: N/A

60-5 **Record** LO_2 Fast Fill start date and time (GMT).

LO_2 Fast Fill Date 11/23/02 GMT Time 1641 GMT

ETM MS 17 Date 11/23/02

Not Performed: N/A

60-6 **CVM1 JTV1 223**

From start of LO_2 Fast Fill until LO_2 stable replenish mode is established, **monitor/videotape** ET-TPS surfaces on OTV cameras 004/104, 013/113, 060/160, 061/161, 062/162, 063/163, 064/164, 068/168, and 069/169. **Scan** LO_2 Tank. **Alternate** cameras and **scan** from Intertank to LO_2 Barrel Splice to GO_2 Vent Hood. No cryogenic liquid or excessive vapors allowed.

ETM MS 17 Date 11/23/02

Support: COMM

Not Performed: N/A

LL-02

60-7 **Record** LO_2 Topping date and time (GMT).

LO_2 Topping Date 11/23/02 GMT Time 1842 GMT

MS 17

ETM _____ Date 11/23/02

Not Performed: N/A

60-8 **Record** LO_2 Stable Replenish mode start date and time (GMT).

LO_2 Stable Replenish Date 11/23/02 GMT Time 1848 GMT

MS 17

ETM _____ Date 11/23/02

Not Performed: N/A

60-9 **CVM1 JTV1 223**

From time LO_2 Stable Replenish mode is established until time for final SSV scan (approximately L-2 hours), **monitor, scan and videotape** ET-TPS surfaces on OTV cameras 004/104, 013/113, 060/160, 061/161, 062/162, 063/163, 064/164, 068/168, and 069/169. No cryogenic liquid or excessive vapors allowed.

MS 17

ETM _____ Date 11/23/02

Support: COMM

Not Performed: N/A

1-1-03

Final SSV Inspection Scan

NOTE

Final SSV Inspection Scan should begin not later than 1.5 hours prior to start of T-9 minute hold (approximately L-2 hours) to allow ample time to finish. Final SSV Inspection Scan shall include the ET, SRB's and the Orbiter.

Final scan may be altered or partially performed in the event that time constraints will not permit a complete SSV scan prior to start of T-9 minute hold.

During Final SSV Inspection Scan the camera lights on OTV cameras 061/161 and 062/162 shall be turned "Off" when view passes over the Orbiter cockpit to preclude "distracting" the Flight Crew.

60-10 CVM1 JTV1 223

Perform Final SSV Inspection Scan with OTV cameras 004/104, 013/113, 060/160, 061/161, 062/162, 063/163 and 064/164. Scan passes shall view entire SSV with cameras at approximate full zoom in during final scan.

ETM Mark Wollam Date 11/23/02
MARK WOLLAM

Not Performed: NA

Terminal Count Camera Positions

NOTE

This step performed for SSME ignition only and may be not performed if launch is scrubbed prior to pick-up of T-9 minute count. Cameras must be positioned for ignition no later than T-9 minutes. "Spot" scanning after pick-up of the T-9 minute count is acceptable with CICE concurrence.

Cameras may be positioned for SSME ignition in an arbitrary order.

Camera positions may be altered real-time with CICE concurrence. Alterations should be determined prior to pick-up of T-9 minute count to allow sufficient time for OTV operators to rehearse camera movements.

CVM1 camera positions for SSME ignition are defined in Table 60-1.

60-11 **CVM1** **JTV1** **223**

Ref Table 60-1, **position** cameras 004/104, 013/113, 042/142, 054/154, 060/160, 062/162 for terminal count.

ETM Mark Wollam Date 11/23/02
MARK WOLLAM Support: COMM

Not Performed: NA

60-12 Operation - Group 1 Monitoring - LO_2 Chill Down Thru T-0 complete.

Table 60-1 CVM1 Camera Positions for Terminal Count

NOTE

This Table defines CVM1 camera positions for terminal countdown. Cameras should be positioned for ignition no later than pick-up of T-9 minutes count. "Spot" scanning after pick-up of the T-9 minute count is acceptable with CICE concurrence.

Cameras may be positioned for SSME ignition non-sequentially.

Camera positions may be altered real-time with CICE concurrence. Alterations should be determined prior to pick-up of T-9 minute count to allow sufficient time for operators to rehearse camera movements with ice console.

The GO_2 Vent Arm (GVA) retracts at T-2m30s.

CVM1 Camera Positions Are Defined As Follows:

004/104

GUCP centered in frame so that GUCP will stay in view throughout SRB "twang".

042/142

At approximately T-1 hour, view and monitor Orbiter access arm while Orbiter hatch is being closed.

At **T-7m30s**, watch Orbiter access arm retract, then view bipod strut in center of frame, LO_2 feedline fairing in top of frame, and Orbiter hatch in right of frame.

054/154

At **T-3m50s**, view Orbiter right hand body flap movement, then zoom out with Orbiter/ET umbilicals at approximate frame center, Orbiter trailing edge at frame bottom, and edge of +Y (RH) SRB just in view at frame right.

Table 60-1 CVM1 Camera Positions for Terminal Count

013/113
At **T-2m30s**, watch lift of GO_2 vent arm for debris and nose cone/vent louvers for ice damage. Immediately following lift of GO_2 vent arm, center frame on GO_2 vent louver and then zoom-out so that entire ET movement is seen during SRB 'twang' at SSME ignition.

060/160
At approximately **T-2m30s**, after GO_2 vent arm retracts, go full zoom in for a close-up inspection of the GO_2 vent louver. After CICE concurrence, go full zoom out and position camera with SSV centered and ET nose cone at frame top.

062/162
At approximately **T-2m30s**, after GO_2 vent arm retracts, go full zoom in for a close-up inspection of the -Y GO_2 vent louver. After CICE concurrence, zoom out until ET nose spike is at top of frame with ET centered.

061/161
At approximately **T-4m00s**, verify camera lights are off. Then position camera to view astronaut closing visor at T-2 minutes 00 seconds.

068/168 and 069/169
Immediately after GO2 vent hood lift, turn lights off to preclude distracting orbiter crew when the GVA rotates to its latchback position.

PgI WC 150 USA SEP 18 '02

063/163
SRB AND ORBITER WING IN VIEW CENTERED OVER LH2 FIREDETECTION SYSTEM (BUTCHER PAPER)

***** End of Table 60-1 Camera Positions for Terminal Count *****

*** End of Operation 60 ***

OPERATION 70 Group 2 Monitoring - LH_2 Chill Down Thru T-0

Shop: **SE**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **15.0**

NOTE

Do not perform this operation if launch scrub declared before start of LH_2 Chill Down.

Operation Not Performed: N/A

NOTE

This operation monitors LH_2 Barrel and associated components/areas start of LH_2 Chill Down to pre-pressurization via OTV cameras 009/109, 033/133, 054/154, 055/155, 056/156, 065/165, 066/166 and 067/167.

Steps in this operation are contingent upon progression of launch countdown operations and may be not performed if countdown is terminated.

LH_2 Chill Down To L-2 Hour Mark

70-1 CVM2 JYVR 138

At start of LH_2 Chill Down, **start** recorders for cameras 009/109, 033/133, 054/154, 055/155, 056/156, 065/165, 066/166 and 067/167.

ETM ME 08 Date 11-23-02

Support: COMM

70-2 **Record** LH_2 Chill Down start date and time (GMT).

LH_2 Chill Down Date 11-23-02 Time 14:28 GMT

ETM ME 08 Date 11-23-02

70-3 CVM2 JTV2 225

From start of propellant loading until start of LH_2 Fast Fill on OTV cameras 033/133, 054/154, 055/155, 056/156, 065/165, 066/166 and 067/167, **monitor/videotape** ET-TPS surfaces. No cryogenic liquid or excessive vapors allowed.

ETM ME 08 Date 11-23-02

Support: COMM

Not Performed: N/A

70-4 **Record** LH_2 Slow Fill start date and time (GMT).

LH_2 Slow Fill Date 11-23-02 Time 15:56 GMT

ME 08

ETM _____ Date 11-23-02

Not Performed: N/A

70-5 **Record** LH_2 Fast Fill start date and time (GMT).

FOR MEO8 1-6-03
OR 04

LH_2 Fast Fill Date 11-23-02 Time ~~16:16~~ 16:33 ① EXE GMT

① ME 08

ETM _____ Date 11-23-02

Not Performed: N/A

70-6 **CVM2 JTV2 225**

From start of LH_2 Fast Fill until stable replenish mode is established, **scan** LH_2 Tank. **Alternate** OTV cameras 033/133, 054/154, 055/155, 056/156, 065/165, 066/166 and 067/167 and **scan/videotape** from LH_2 Aft Dome to Intertank.

ME 08

ETM _____ Date 11-23-02

Support: COMM

Not Performed: N/A

70-7 **Record** start date and time (GMT) for LH_2 Topping.

LH_2 Topping Date 11-23-02 Time 17:44 GMT

ME 08

ETM _____ Date 11-23-02

Not Performed: N/A

70-8 **Record** LH_2 Stable Replenish mode start date and time (GMT).

LH_2 Stable Replenish Date 11-23-02 Time 18:20 GMT

ME 08

ETM _____ Date 11-23-02

Not Performed: N/A

70-9 **CVM2 JTV2 225**

During LH_2 Stable Replenish mode and until time for final scan (approximately L-1.5 hours), on OTV cameras 033/133, 054/154, 055/155, 056/156, 065/165, 066/166 and 067/167, **monitor/videotape** ET TPS surfaces including LO_2 Feed Line, LH_2 Feed Line, LH_2 Recirculation Line, LH_2 Aft Dome and manhole covers, LH_2/LO_2 Umbilicals, and TSM LH_2/LO_2 Umbilicals. No cryogenic liquid or excessive vapors allowed.

ME 08

ETM _____ Date 11-23-02

Support: COMM

Not Performed: N/A

Final SSV Inspection Scan

NOTE

Final SSV Inspection Scan should begin not later than 1.5 hours prior to start of T-9 minute hold (approximately L-2 hours) to allow ample time to finish. Final SSV Inspection Scan shall include the ET, SRB's and the Orbiter.

Final SSV Inspection Scan may be altered or partially performed in the event that time constraints will not permit a complete SSV scan prior to start of T-9 minute hold.

70-10 CVM2 JTV2 225

Perform Final SSV Inspection Scan with OTV cameras 009/109, 033/133, 054/154, 055/155, 056/156, 065/165, 066/166 and 064/164. Scan passes shall view entire SSV with cameras at full zoom in during final scan.

ETM R Brewer Date 11-23-02

Support: COMM

Not Performed: N/A

T-9 Minute Terminal Count

NOTE

Next step performed for terminal count only and may be not performed if launch is scrubbed prior to pick-up of T-9 minute terminal count. Cameras must be positioned for SSME ignition no later than T-9 minutes. 'Spot' scanning after pick-up of the T-9 minute terminal count is acceptable with CICE concurrence.

Cameras may be positioned for SSME ignition in an arbitrary order.

Camera positions may be altered real-time with CICE concurrence. Alterations should be determined prior to pick-up of T-9 minute count to allow sufficient time for OTV operators to rehearse camera movements.

CVM2 camera positions for terminal count are defined in Table 70-1.

70-11 **CVM2** **JTV2** **225**

Ref Table 70-1, **position** cameras 009/109, 033/133, 056/156, 065/165, 066/166 061/161, 070/170, 071/171 and 067/167 for terminal count.

ETM R Brewer Date 11/23/02

Support: COMM

Not Performed: N/A

70-12 Operation - Group 2 Monitoring - LH_2 Chill Down Thru T-0 complete.

Table 70-1 - CVM2 Camera Positions for Terminal Count

NOTE
This Table defines CVM2 camera positions for terminal countdown. Cameras should be positioned for ignition no later than pick-up of T-9 minutes count. "Spot" scanning after pick-up of the T-9 minute count is acceptable with CICE concurrence. The Orbiter access arm (OAA) retracts at T-7M30S. Orbiter body flap movement occurs at T-3m50s. Cameras may be positioned for SSME ignition non-sequentially Camera positions may be altered real-time with CICE concurrence. Alterations should be determined prior to pick-up of T-9 minute count to allow sufficient time for operators to rehearse camera movements with ice console.

Group 2 Camera Positions Are Defined As Follows:

033/133
Full zoom out. LO_2 feed line in frame center and MLP deck at bottom.

055/155
View ET aft dome with MLP deck just out of view at bottom, ET XT-2058 ring frame at frame top and both SRB's just in view at sides.

056/156
View ET aft dome with MLP deck just out of view at bottom. ET XT-2058 ring frame at frame top and both SRB's just in view at sides.

065/165
Full zoom out. SSV centered. MLP deck edge just in view at bottom.

066/166
ET centered. Intertank to LO_2 Barrel splice at frame top with the majority of Orbiter wing in view.

067/167
Center on GUCP for optimum view.

070/170 and 071/171
At **T-9m00s**, zoom in on space shuttle main engine with camera providing best view. Zoom out on SSME for wide angle view with other camera.

009/109
At approximately **T-3m50s**, position to view Orbiter body flap and elevons movement. Afterwards, center on LH_2 umbilical with -Y vertical strut at frame top.

061/161
At approximately **T-1m30s**, tilt-up to GO_2 Vent Footprint. Zoom in. Pause. If footprint is acceptable, zoom out and tilt down to view Orbiter nose/cockpit through liftoff.

***** End of Table 70-1 - CVM2 Camera Positions for Terminal Count *****

*** End of Operation 70 ***

OPERATION 80 Final Inspection

Shop: **SE**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **PAD A/B**
Hazard (Y/N): **Y**
Duration (Hrs): **3.0**

NOTE

Final Inspection may not need to be performed depending on LO_2/LH_2 tanking and launch countdown, as determined by CTC/TTL.

Final Inspection Team stay time guidelines for each level are given in Table 80-1. These guidelines are for reference only and may be deviated from at PICE discretion.

Operation Not Performed: N/A

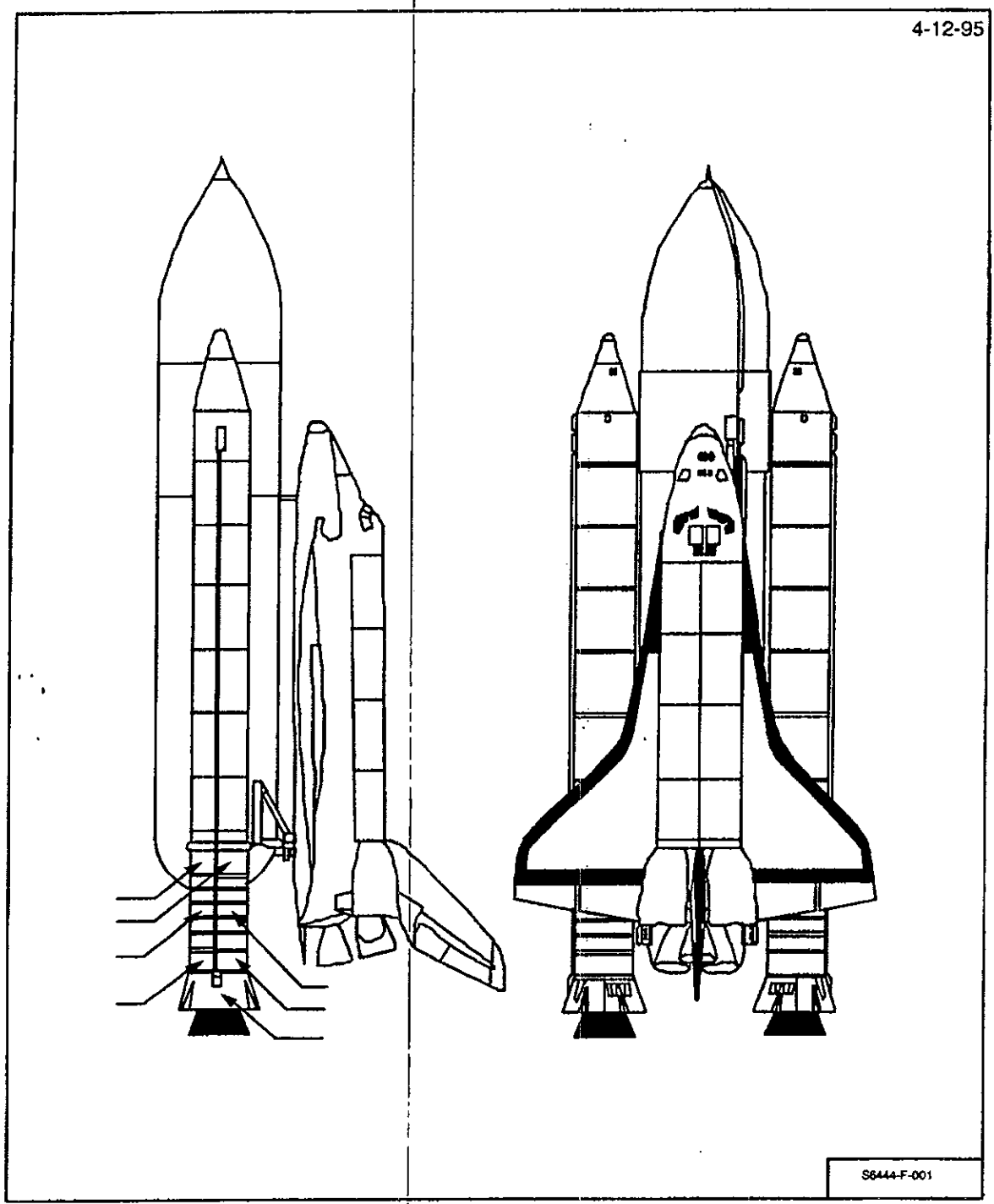


Figure 80-1: Deck (0) Level
(For Reference Only)

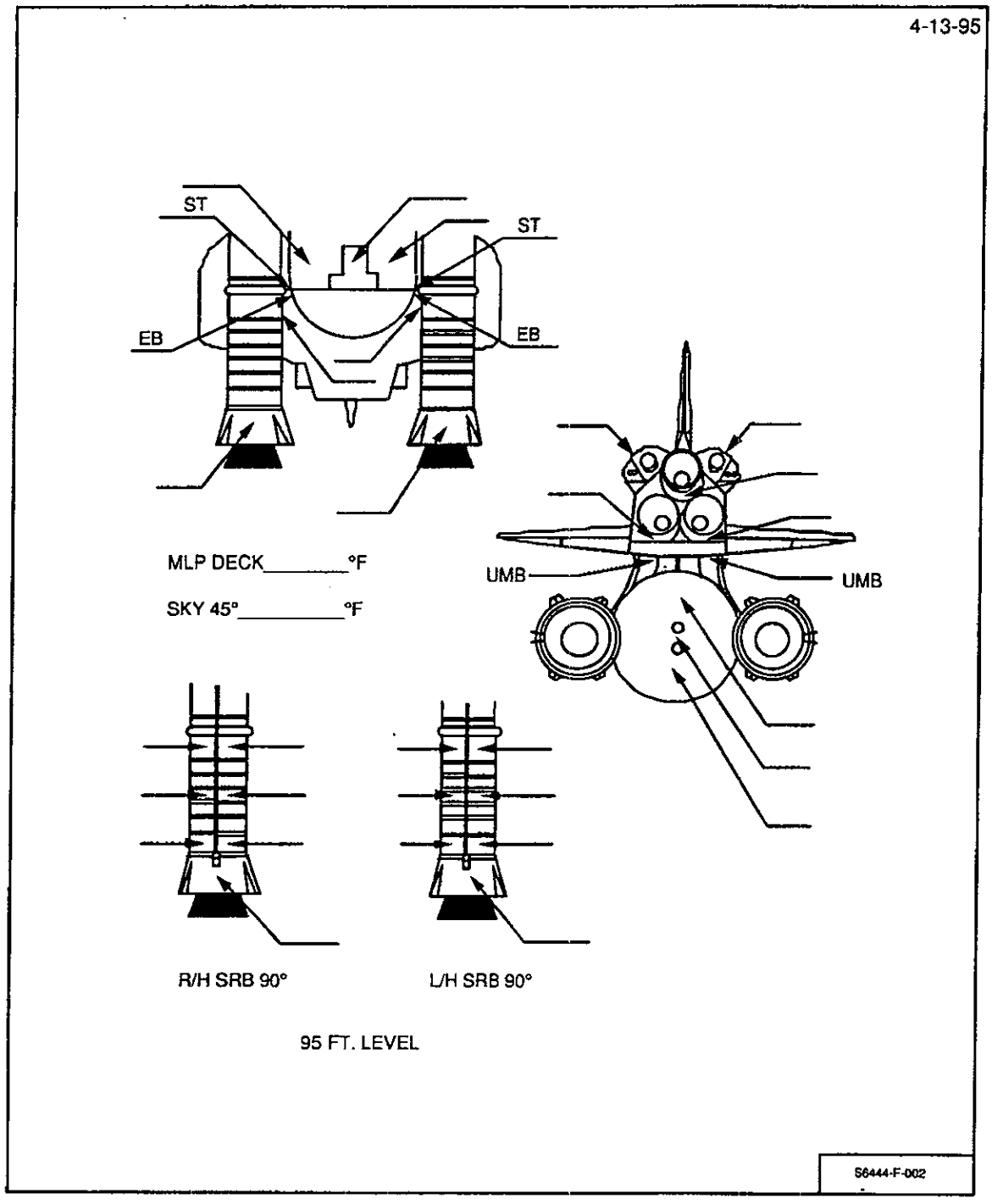


Figure 80-2: Deck (0) and 95 Ft Levels (For Reference Only)

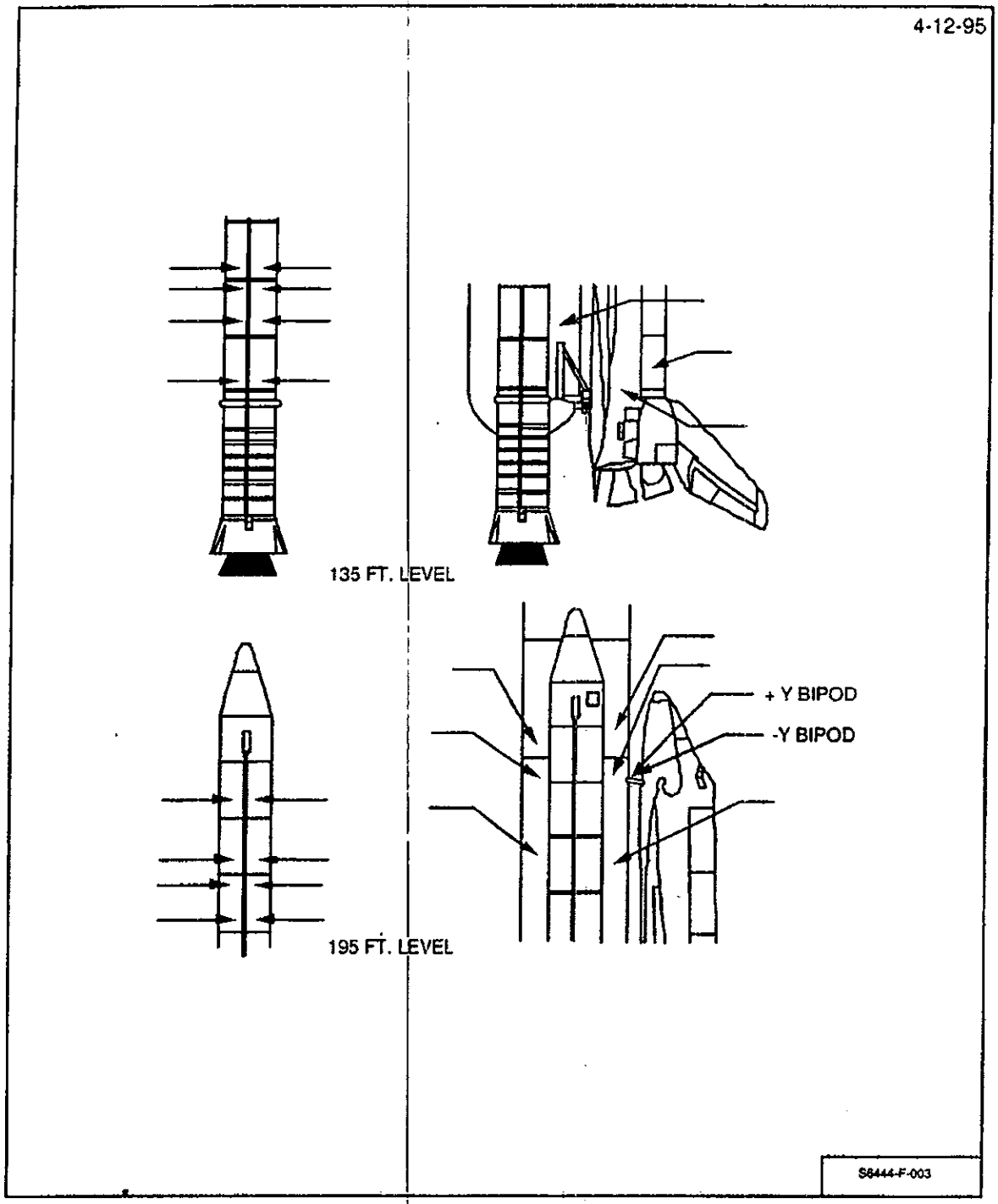


Figure 80-3: 135 and 195 Ft Levels
(For Reference Only)

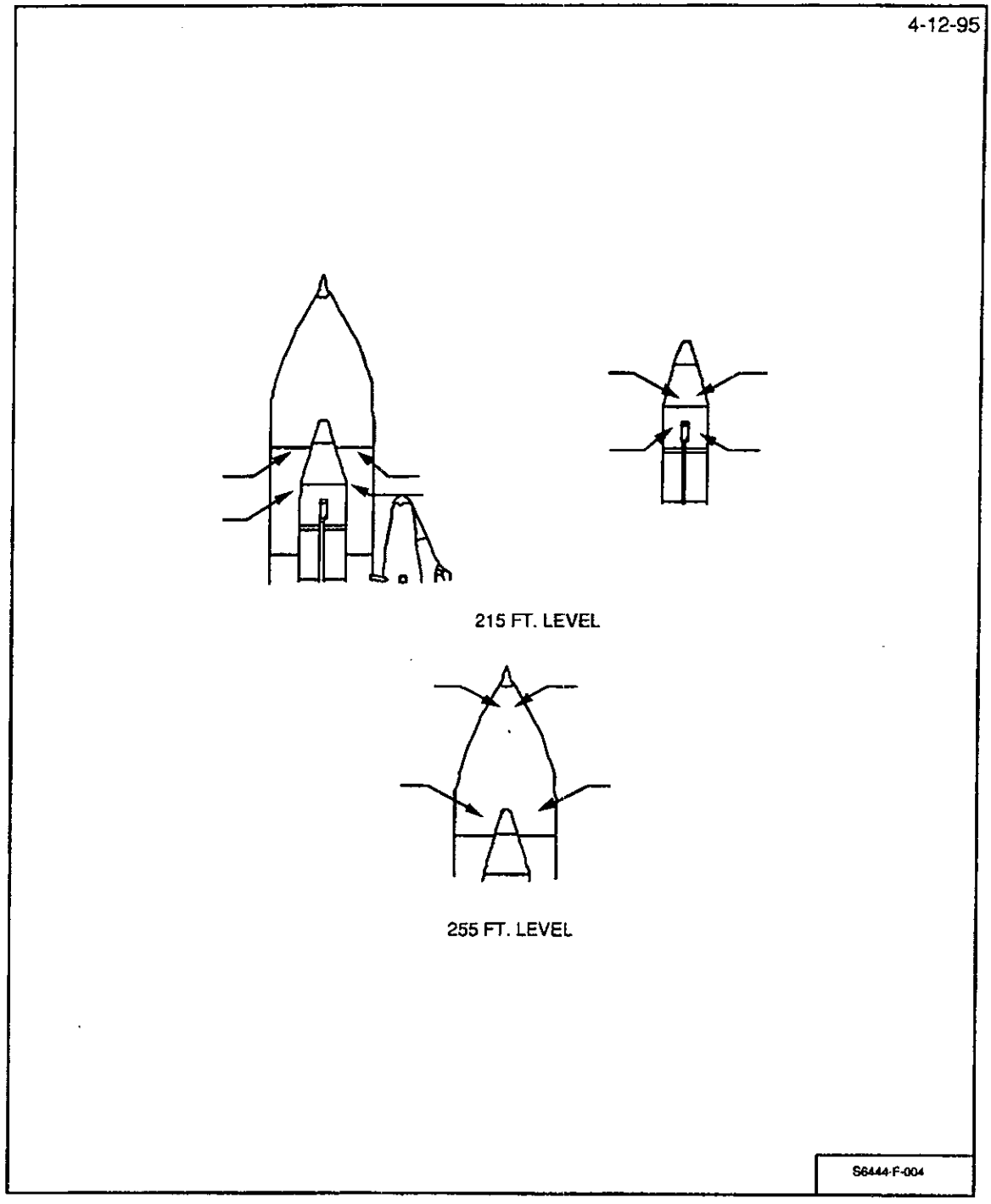


Figure 80-4: 215 and 255 Ft Levels
(For Reference Only)

WARNING

Personnel working at heights greater than 4 feet and within 6 feet of an unguarded edge shall wear a **safety harness** with a **lanyard** secured to an approved tie off point, substantial structural member (no handrails) or a properly installed life line.

WARNING

Personnel performing final inspection shall be attired in **Nomex coveralls with gloves and hoods**. Personnel shall have available gloves, hoods, and **ELSA** at all times during walkdown.

Personnel using Sony DKC-ID1 camera shall verify lithium ion battery is securely locked in bayonet connector and the lithium button battery door is locked and taped in place. Personnel shall ensure the flash is not activated on the camera.

Personnel using Kodak DC-50/120 shall verify alkaline batteries are properly installed and the flash is not active on the camera.

Personnel using digital cameras (Sony DKC ID1, Kodak DC-50/120 shall not use these cameras in the presence of a hydrogen leak or an oxygen enriched atmosphere (readings greater than 23 percent O_2).

NOTE

Task Team Leader (TTL) for final inspection is PH-H. Additional personnel (listed below) may be added to the final inspection team with CTC, Launch Director, and Safety concurrence.

JSC Level II	(1)
PH-H	(2)
SFOC ETM	(1)

80-1 **Assemble** following final inspection team members:

TTL - PH-H	(1)
PH-H	(1)
SFOC ETM	(2)
LMSSC LSS	(1)
SFOC Safety	(1)

80-2 Final inspection team **perform** walkdown of SSV and associated facilities as follows:

NOTE

Following substep may be not performed with TTL concurrence.

Tables 80-2 and 80-3 are reference only items. Images are to be taken of targets of opportunity. Images must be taken with 35 mm and digital cameras. Digital images shall be inputted into SIMS.

1. Ref Tables 80-2 and 80-3, photograph SSV points of opportunity during final inspection using 35 mm. **Record** data.

Roll No. N/A

Negative No. N/A

Work order No. N/A

Sub Step Not Performed: ET/05 11-23-02

2. Reference Tables 80-2 and 80-3, **take** digital image of SSV points of opportunity using digital camera.

Description: Final Inspection Team

SPC No. 51363

Disc/Frame Nos: 1-70

3. See Figures 80-1 through 80-4, **measure and record** (deg F) SSV external surface temperatures using IR gun(s)/scanners.

NOTE

The following substep references inspection areas. However, inspection shall not be limited to these areas. Inspection shall be of entire SSV and specific areas of concern as defined by the TTL, CTC, or Launch Director.

4. **Visually inspect:**

- Orbiter aft engine compartment external surfaces for condensation and ice formations.
- ET TPS surfaces which cannot be observed by the OTV system.
- Specific areas of concern as determined by the TTL, CTC, or Launch Director.

OMRSD S00U00.020-A-1

OMRSD S00U00.020-C-1 USA VM 141

OMRSD S00U00.020-D-1

80-3 Final Inspection complete. **Verify** no constraints to continue. **Forward** description(s) of debris found to SFOC QC for entry into Processing Debris / FOD Database.

TTL (PH-H) _____ Date 11/23/02

SFOC-ETM ✓ Tom Ford Date 11.23.02

80-4 Operation - Final Inspection complete.

ETM _____ Date 11-23-02

Table 80-1 Final Inspection Team Walkdown Stay Times

255 Ft Level - 5 Minutes

- LO_2 Ogive and Barrel acreage
- GO_2 Pressurization Line
- LO_2 Tank Cable Tray
- Visible LH SRB surfaces
- GO_2 Vent Ducts

215 Ft Level - 20 Minutes

- ET GH_2 7 inch Vent Assembly
- ET acreage (between -Z and -Y axis)
- GO_2 vent area
- Orbiter tiles
- Visible SRB surfaces
- Inter tank-to-LO_2 Barrel splice

195 Ft Level - 10 Minutes

- LO_2 Feed Line
- ET/Orbiter Bipods (side and bottom view)
- -Y ET/SRB forward attachment (bottom view)
- -Y ET/SRB aft attachments (top view)
- Inter tank splice areas (LO_2 and LH_2)
- ET acreage (between -Y and +Z axis)
- Orbiter tiles
- Visible LH SRB surfaces

135 Ft Level - 10 Minutes

- LH_2 ET/Orbiter Umbilical
- -Y ET/SRB C/T
- -Y Vertical Strut
- LO_2 Feed Line
- ET acreage between -Y axis and +Z axis
- ET/Orbiter attachments (top view)
- Visible LH SRB surfaces
- Orbiter aft fuselage

Table 80-1 Final Inspection Team Walkdown Stay Times
0 Level - 30 Minutes

- LH_2 Aft Dome
- ET acreage around +Z axis
- ET acreage around -Z axis
- LO_2 Feed Line
- LH_2 Feed Line
- ET/Orbiter attachments - Bottom view
- ET/Orbiter LH_2 and LO_2 Umbilicals
- T-0 LH_2 and LO_2 Umbilicals
- Space Shuttle Main Engines (SSME)
- Orbiter tiles
- ET/SRB aft attachments
- Visible SRB surfaces
- SRB ignition overpressure sound suppression water troughs

*** End of Table 80-1- Final Inspection Team Walkdown Stay Times ***

Table 80-2 Final Inspection Team - Telephotos

TELEPHOTOS - 255 FT LVL

Photo	Camera Orientation	Notes
GO_2 Vent Ducts	Horizontal	
LO_2 Acreage	Vertical	

TELEPHOTOS - 215 FT LVL

Photo	Camera Orientation	Notes
-Y Bipod Ramp	Horizontal	From RSS
LO_2 P/L Ice Frost Ramps	Vertical	From RSS; Requires 3-4 shots
GO_2 Seal/Hood	Horizontal	From haunch & RSS
GUCP	Vertical	

TELEPHOTOS - 195 FT LVL

Photo	Camera Orientation	Notes
-Y Bipod Ramp & Jack PAD C/O	Horizontal	

TELEPHOTOS - 135 FT LVL

Photo	Camera Orientation	Notes
LH_2 UMB	Horizontal	
-Y Longeron	Vertical	If needed
Jack Pad Closeouts	Horizontal	
LH_2 Acreage	Vertical	

Table 80-2 Final Inspection Team - Telephotos

TELEPHOTOS - MLP

Photo	Camera Orientation	Notes
LH_2 UMB	Horizontal	From West
LH_2 UMB	Horizontal	From NW
EB-7	Horizontal	
EB-8	Horizontal	
LH_2 Aft Dome	Horizontal	
Third Hard Point C/O	Vertical	
LH_2 Barrel	Horizontal	From North
SSV Overall	Horizontal	From North
SSV Overall	Horizontal	From East
LO_2 F/L Bracket & Bellows	Vertical	XT-1973
LO_2 F/L Bracket	Vertical	XT-1871
LO_2 F/L Bracket	Vertical	XT-1623
LO_2 F/L Bracket	Vertical	ST-1377 & XT-1129
LO_2 F/L Bracket & Bellows	Vertical	XT-1129 & XT-1106 from SE
LO_2 P/L & C/T	Vertical	From SE

600 MM PHOTOS - 255 FT LVL

Photo	Shutter Speed	Notes
GO_2 Vent Ducts	1/30	Contingency

Table 80-2 Final Inspection Team - Telephotos

600 MM PHOTOS - 215 FT LVL

Photo	Shutter Speed	Notes
-Y GO_2 Seal	1/30	
-Y Bipod Ramp	1/30	Contingency
Jack Pad C/O's	1/4	Difficult if windy
LO_2 F/L	1/15	
-Y Vertical Strut (Crack)	1/30	

600 MM PHOTOS - 195 FT LVL

Photo	Shutter Speed	Notes
-Y Bipod Ramp	1/30	Contingency

600 MM PHOTOS - 135 FT LVL

Photo	Shutter Speed	Notes
LH_2 UMB	1/30	
-Y Vertical Strut (Crack)	1/60	
LO_2 F/L Bellows	1/15	Contingency

Table 80-2 Final Inspection Team - Telephotos

600 MM PHOTOS - MLP

Photo	Shutter Speed	Notes
LH_2 UMB	1/30	From West
LH_2 UMB	1/30	From NW
LH_2 UMB	1/30	From East
LH_2 UMB Actuator C/O	1/15 or 1/30	From North standing next to water pipe
LO_2 UMB	1/5	Lower Inboard
LO_2 UMB	1/8	Inboard
LO_2 F/L Bracket & Bellows	1/15	One photo to include XT-1978 & XT-1973
LO_2 F/L Bracket	1/15	XT-1871
LO_2 F/L Bracket	1/15	XT-1623
LO_2 F/L Bracket	1/15	XT-1377
LO_2 F/L Bracket	1/30	One photo to include XT-1129 & XT-1106
LO_2 F/L Bracket	1/30	From SE corner; One photo to include XT-1129 & XT-1106
Jack Pad C/O's	1/15	From SE corner
Ice Frost Ramps or Pal Ramps	1/15 or 1/30	Contingency
LH_2 UMB Inboard	1/15	From East
+Y Longeron	1/15 or 1/30	Contingency
-Y Longeron	1/15	Contingency

Table 80-2 Final Inspection Team - Telephotos

WIDE ANGLE PHOTOS - 255 FT LVL

Photo	Camera Orientation	Lens	Notes
LO_2 Tank	Vertical	35-70 mm	
GO_2 Vent Ducts	Horizontal	35-70 mm	

WIDE ANGLE PHOTOS - 215 FT LVL

Photo	Camera Orientation	Lens	Notes
Overall GH_2 Vent Line	Horizontal	35-70 mm	
Orbiter Nose, ET -Y Side	Horizontal	35-70 mm	
Orbiter Nose, ET -Y, +Z Side	Horizontal	35-70 mm	From RSS
Forward Half of Vehicle	Vertical	28 mm	From RSS
Entire Orbiter	Vertical	28 mm	From RSS

WIDE ANGLE PHOTOS - 195 FT LVL

Photo	Camera Orientation	Lens	Notes
Aft Part of SSV, LH Wing	Vertical	35-70 mm	
Orbiter Fwd Section, Upper LH_2 Tank	Vertical	35-70 mm	
Bipod, -Y, +Z Intertank Area	Horizontal	35-70 mm	

Table 80-2 Final Inspection Team - Telephotos

WIDE ANGLE PHOTOS - 135 FT LVL

Photo	Camera Orientation	Lens	Notes
Orbiter Aft Section	Vertical	35-70 mm	
Lower LH_2 Tank & LH SRB	Vertical	35-70 mm	

WIDE ANGLE PHOTOS - MLP

Photo	Camera Orientation	Lens	Notes
Overall Orbiter Left Side	Vertical	28 mm	
ET -Y, +Z Quadrant	Vertical	28 mm	
ET -Z Side	Vertical	28 mm	
ET +Y, +Z Quadrant	Vertical	28 mm	
Overall Orbiter Right Side	Vertical	28 mm	
ET Aft Dome	Horizontal	35-70 mm	
-Z Side of LO_2 T-0; RCS Stinger	Horizontal	35-70 mm	
+Z Side of LO_2 T-); RCS Stinger OMS Nozzle	Horizontal	35-70 mm	
-Z Side of LH_2 T-0; RCS Stinger	Horizontal	35-70 mm	
+Z Side of LH_2 T-0; RCS Stinger OMS Nozzle	Horizontal	35-70 mm	
Overall SSME Cluster	Horizontal	50 mm	-Y Side
SSME No. 2	Horizontal	50 mm	
SSME No. 1, -Z Side	Horizontal	50 mm	
SSME No. 3	Horizontal	50 mm	
Overall SSME Cluster	Horizontal	50 mm	+Y Side

Table 80-2 Final Inspection Team - Telephotos

WIDE ANGLE PHOTOS - MLP (continued)

Photo	Camera Orientation	Lens	Notes
LO_2 UMB Area	Horizontal	35-70 mm	
LH_2 UMB Area	Horizontal	35-70 mm	
ET/ORB UMB & ORB Lower Surface	Horizontal	28 mm	From under ET

*** End of Table 80-2 Final Inspection Team - Telephotos ***

1-6-03

Table 80-3 Reduced Final Inspection Team Photos

WIDE ANGLE & TELEPHOTO PHOTOGRAPHY - 255 FT LVL

Photo	Camera Orientation	Lens	Notes
GO_2 Vent Ducts	TELE	Horizontal	

WIDE ANGLE & TELEPHOTO PHOTOGRAPHY - 215 FT LVL

Photo	Camera Orientation	Lens	Notes
-Y Bipod Ramp	Horizontal	TELE	From RSS
LO_2 P/L Ice/Frost Ramps	Vertical	TELE	From RSS; 2 photos required
GO_2 Seal/Hood	Horizontal	TELE	From RSS
GUCP	Vertical	TELE	
Fwd Half of SSV	Vertical	28 mm	From RSS
Entire Orbiter	Vertical	28 mm	From RSS

WIDE ANGLE & TELEPHOTO PHOTOGRAPHY - 195 FT LVL

Photo	Camera Orientation	Lens	Notes
-Y Bipod Ramp & Jack Pad C/O's	Horizontal	TELE	

Table 80-3 Reduced Final Inspection Team Photos

WIDE ANGLE & TELEPHOTO PHOTOGRAPHY - 135 FT LVL

Photo	Camera Orientation	Lens	Notes
LH_2 UMB	Horizontal	TELE	
Orbiter Aft Section	Vertical	35-70 mm	

WIDE ANGLE & TELEPHOTO PHOTOGRAPHY - MLP DECK

Photo	Camera Orientation	Lens	Notes
LH_2 UMB	Horizontal	TELE	From West
ET Aft Dome	Horizontal	TELE	
Aft Hard Point Closeout	Vertical	TELE	
LH_2 Tank	Horizontal	TELE	From North
LO_2 Tank	Horizontal	TELE	From North
LO_2 Tank	Horizontal	TELE	From East
LO_2 F/L Bracket Bellows	Horizontal	TELE	XT - 1978 & XT - 1973
LO_2 F/L Bracket	Horizontal	TELE	XT - 1871
LO_2 F/L Bracket	Horizontal	TELE	XT - 1623
LO_2 F/L Brackets	Horizontal	TELE	XT - 1377 & XT - 1129
LO_2 F/L Brackets & Bellows	Horizontal	TELE	XT - 1129 & XT - 1108; from SE
LO_2 P/L & C/T	Horizontal	TELE	From SE
Overall Orbiter Left Side	Vertical	28 mm	
ET -Z Side	Vertical	28 mm	
Overall Orbiter Right Side	Vertical	28 mm	
Overall SSME Cluster -Y Side	Horizontal	28 mm	

Table 80-3 Reduced Final Inspection Team Photos

WIDE ANGLE & TELEPHOTO PHOTOGRAPHY - MLP DECK (continued)

Overall SSME Cluster +Y Side	Horizontal	28 mm	
ET/Orb UMB & Orbiter Lower Surface	Horizontal	28 mm	From under ET

*** End of Table 80-3 - Reduced Final Inspection Team Photos ***

*** End of Operation **80** ***

11-03

OPERATION 90 LO_2/LH_2 Drain Monitoring

Shop: **SE**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **4.0**

NOTE

This operation is contingent upon progression of launch countdown and is performed after start of cryo (LO_2/LH_2) loading and subsequent launch scrub, FRF, or WCDDT.

Operation Not Performed: KEJ 05 11-23-02

NOTE

This operation monitors the External Tank external surfaces during LO_2/LH_2 drain operations from time of detanking until 1.5 hours after LO_2/LH_2 low level sensors read dry via OTV 004/104, 009/109, 013/113, 033/133, 042/142, 054/154, 055/155, 056/156, 060/160, 061/161, 062/162, 063/163, 064/164, 065/165, 066/166, 067/167, 068/168, 069/169, 070/170, and 071/171.

Noted requirements satisfied by this operation: OMRS S00E00.021

90-1 **Record** start date/time (GMT) of LH_2 and LO_2 Tank Drain.

LH_2 Drain Start Date _____ Time _____ GMT

LO_2 Drain Start Date N/A Time N/A GMT

ETM _____ Date _____

90-2 CVM1 JTV1 223

From start of LO_2 Tank Drain and LH_2 Tank Drain until respective LO_2/LH_2 low level sensors read dry, **monitor** ET external surfaces including LO_2 Feed Line, LH_2 Feed Line, LH_2 Recirculation Line, LH_2 Aft Dome and manhole covers, LH_2/LO_2 Umbilicals, TSM LH_2/LO_2 Umbilicals via OTV cameras. No cryogenic liquid or excessive vapors allowed.

ETM _____ Date_____

Support: COMM

90-3 **Record** date/time (GMT) when LO_2/LH_2 low level sensors read dry.

LH_2 Sensors Dry Date _____ Time_____ GMT

LO_2 Sensors Dry Date _____ Time_____ GMT

ETM _____ Date_____

90-4 **CVM1 JTV1 223**

Monitor ET external surfaces including LO_2 Feed Line, LH_2 Feed Line, LH_2 Recirculation Line, LH_2 Aft Dome and manhole covers, LH_2/LO_2 Umbilicals, TSM LH_2/LO_2 Umbilicals via OTV cameras for 1.5 hours after LO_2/LH_2 low level sensors have read dry. No cryogenic liquid or excessive vapors allowed. Record date/time (GMT) when monitoring complete.

LH_2 Complete Date _____ Time _____ GMT

LO_2 Complete Date _____ Time _____ GMT

ETM_____ Date_____

Support: COMM

WC 150 USA SEP 18 '02 Dev. 90 Inc. 01 P 1/6/03

SEE DEV

90-5 Completion of this operation satisfies noted requirements.

USA VM 075

OMRSD S00E00.021

90-6 Operation - LO_2/LH_2 Drain Monitoring complete.

*** End of Operation **90** ***

NP

1/03

OPERATION 100 Console Securing

Shop: SE
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **0.5**

100-1

CTIF TBC 136
TBC CTC 232

OTV support for ET thermal protection system evaluation no longer required.

100-2

CTIF JYVR 138

Perform the following:

1. **Turn off** video recorders.
2. **Remove** tape cartridges.
3. OTV support no longer required.

Support: COMM

100-3

CTIF CVM1 222
CVM2

Secure consoles by setting all monitors to "Off" position.
Report completion.

NOTE

Perform next step only after a successful launch.

100-4 CTIF

Remove photo processing laptop computer from Firing Room.

ET/05

Not Performed: 11-23-02

100-5

CTIF	**TBC**	**136**
TBC	**CTC**	**232**

Firing Room 2, ice frost monitoring area securing complete.

100-6 Operation 100 - Console Securing complete.

ETM [signature] Date 11-23-02

*** End of Operation **100** ***

OPERATION 110 Summary Tape

Shop: **SE**
Cntrl Rm Console: **FR2**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **18.0**

NOTE
Observations/concerns observed during count are typically recorded on the summary tape real-time (trouble tape).

110-1 **CICE**

After launch or launch scrub, prepare a summary tape to include observations/concerns noted during count.

110-2 Operation Summary Tape complete.

ETM _____ Date 11-23-02

*** End of Operation **110** ***

OPERATION 120 Post Drain Walkdown

Shop: **SE**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **PAD A/B**
Hazard (Y/N): **Y**
Duration (Hrs): **2.0**

NOTE

Post drain walkdown performed only after start of cryo (LH_2/LO_2) loading and subsequent launch scrub.

Operation Not Performed: ET/05 11-23-02

WARNING

Personnel working at heights greater than 4 feet and within 6 feet of an unguarded edge shall wear a **safety harness** with a **lanyard** secured to an approved tie off point, substantial structural member (no handrails) or a properly installed life line.

Personnel shall wear **hardhats** and **flame retardant coveralls** while performing post drain walkdown.

NOTE

Post drain walkdown typically commences approximately 1.5 hours after LH_2/LO_2 low level sensors read dry.

Post drain walkdown performed in support of a 24 hour scrub turnaround is typically coincident with the L-20 hour pre-launch walkdown for the ensuing launch attempt.

1-6-0

NOTE

NASA ET Mechanical Engineer (PH-H) or designee shall function as team leader. Following personnel are walkdown optional participants:

NASA Engr	(4)
SFOC Engr	(2)
LMSSC-LSS	(1)
Boeing LSS	(1)
SFOC Safety	(1)

120-1 NASA Lead ET Mechanical Systems Engineer (PH-H) verify essential personnel on station, properly attired, and ready to proceed with post drain walkdown.

Essential Personnel	
NASA Engineering (PH-H)	1
SFOC Engineering (ETM)	1

NP

NOTE
"Hands-on Investigation" is applicable only to those areas which are not understood or fully defined and which cannot be adequately evaluated otherwise.

120-2 **Perform** post drain walkdown as follows:

1. **Visually inspect** ET TPS exterior surfaces after detanking and warm-up (approximately T + 4 hours after drain is initiated) from the MLP, FSS, and RSS as access permits.

2. **Perform** hands-on investigation of all areas suspected of violating Doc: NSTS 08303 (LI) NSTS PROGRAM ICE/DEBRIS INSPECTION CRITERIA (LI)

USA VM 075

OMRSD S00E00.031

3. **Photograph** any vehicle / facility concerns observed.

SPC No. N/A

Disc/Frame Nos: N/A

120-3 Walkdown complete. All discrepancies identified. No constraints to continue. **Forward** description(s) of debris found to SFOC QC for entry into Processing Debris / FOD Database.

PH-H N/A Date

ETM N/A Date

120-4 Operation Post Drain Walkdown complete.

*** End of Operation **120** ***

N/A

1-6-03

OPERATION 130 Post Launch Walkdown

Shop: **SE**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **PAD A/B**
Hazard (Y/N): **Y**
Duration (Hrs): **3.0**

NOTE

Do not perform this operation after launch scrub.

Operation Not Performed: N/A

WARNING

Personnel working at heights greater than 4 feet and within 6 feet of an unguarded edge shall wear a **safety harness** with a **lanyard** secured to an approved tie off point, substantial structural member (no handrails) or a properly installed life line.

Personnel participating in walkdown shall wear **hardhats** and **flame retardant coveralls .**

NOTE

NASA ET Mechanical Engineer (PH-H) or designee shall function as team leader. Following personnel are walkdown optional participants:

NASA Engr	(3)
SFOC Engr	(2)
LMSSC-LSS	(1)
Boeing LSS	(2)
SRB ELE	(1)
Thiokol-LSS	(1)
SFOC Safety	(1)
Pad Mgmt Rep	(1)

130-1 NASA (PH-H) **verify** following personnel on station, properly attired, and ready to proceed with post launch walkdown.

Essential Personnel			
NASA		PH-H	1
SFOC		ETM	1

NOTE

Post Launch Walkdown must be performed prior to washdown and Pad being opened for normal work.

130-2 **Perform** Post Launch Walkdown as follows:

1. Ref Table 130-1, **visually inspect** post launch pad/area to identify any lost flight or ground systems hardware and debris sources.

2. Ref Table 130-2, **document/SIMS photograph** launch PAD area configuration.

   Description: Post Launch Walkdown

   OMRSD S00U00.010-1 USA VM 141

   SPC No. 51364

   Disc/Frame Nos: 1-20

130-3 Walkdown complete. Debris sources and lost flight hardware identified. No constraints to continue. **Forward** description(s) of debris found to SFOC QC for entry into Processing Debris / FOD Database.

PH-H A. Diaz Date 11/23/02

ETM R Brewer Date 11-23-02

130-4 Operation - Post Launch Walkdown complete.

Table 130-1 Post Launch Walkdown Inspection Areas

Record mission info, PAD, date, and time:

STS 113 PAD A

Date 11-23-02 Time 23:40

SRB Hold-down posts (HDP)

Inspect for damage, stud hang-up Epon shim material, ordnance fragments, doghouse blast covers, erosion, missing hardware, debris. Record Results:

NORMAL LAUNCH DEBRIS AND EROSION -
NO STUD 'Hangups' NOTED AT THE 8 HOLDDOWNPOSTS.

MLP Deck

SRB aft skirt purge lines
SRB T-0 umbilicals
Tail service masts (TSM's)
MLP deck

195 Ft Level

Orbiter access arm (OAA)

Table 130-1 Post Launch Walkdown Inspection Areas

215 Ft Level - GH2 Vent Line/GUCP

Latch position
Loose cables
Damage from SRB plume
Damage to the QD

255 Ft Level - GO_2 Vent Arm, Ducts, Hood

Seals
Hood windows, doors, latches

Fixed Service Structure (FSS)

Cable tray covers
Signs
Hydraulic leaks
Slidewire baskets

PAD Apron/Acreage

Vehicle hardware and/or flight TPS materials
Facility debris

Table K-1 PAD Apron/Acreage Items

Description	Location
NORMAL MINOR LAUNCH DEBRIS NOTED.	

*** End of Table 130-1 - Post Launch Walkdown Inspection Areas ***

Table 130-2 Post Launch Photos (MLP, FSS, PAD, Apron, Pad Acreage)

MLP 0-level

1 Ea HDP No. 1, 2, 5 & 6 (HDP shoe and Epon shim)
1 Ea HDP No. 3, 4, 7 & 8 (blast cover down to HDP base)
1 Ea SRB T-O umbilical
1 Ea overall view SRB exhaust cutouts\

Any unusual or debris-related damage to the facility; sound suppression water pipes, TSM's cracks in MLP deck, witness panels, handrails, etc.

Any flight hardware debris (tiles, SRB ordnance fragments)
Any facility debris (nuts, bolts, cable tray covers, etc.)

FSS

Close-ups of GUCP and latching mechanism
Overall views of GO_2 vent hood/ducts, if damaged
Any flight hardware or facility debris
Any unusual or debris-related damage to the facility

PAD Apron/PAD Acreage

Any flight hardware or unusual facility debris objects

Any unusual or debris-related damage to the PAD (such as missing brick in the flame trench), perimeter fence, etc.

***** End of Table 130-2 - Post Launch Photos (MLP, FSS, PAD, Apron, Pad Acreage) *****

*** End of Operation **130** ***

OPERATION 140 Film Review

Shop: **SE**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **15.0**

> **NOTE**
> This operation may be not performed after launch scrub.

Operation 140 Not Performed: N/A

> **NOTE**
> Analysis of Pad Debris Inspection Results determines priority for film review. All critical film (as determined by the Debris Team) must be reviewed as soon as possible after launch and no later than 36 hours prior to entry (of the Orbiter into the earth's atmosphere).

140-1 **Review** and **analyze** all engineering launch (and flight) film to:

- Identify any debris damage to the SSV
- Identify flight vehicle or ground system damage that could affect Orbiter flight operations of future SSV launches.

OMRSD S00U00.011-1 USA VM 141

ETM_____ Date 11/24/02

140-2 Operation - Film Review complete.

ETM_____ Date 11/25/02

*** End of Operation **140** ***

OPERATION 145 IR Camera Removal

Shop: **PH-H**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **2.0**

WARNING

Hard hats required on the Pad when SSV is not present.

CAUTION

Exercise care to avoid dropping equipment, fasteners, etc from RSS roof to prevent damage to equipment or injury to personnel. All tools must be tethered.

NOTE

IR Camera removal from RSS Roof site may be not performed in launch scrub turnaround scenarios.

145-1 **Remove** IR camera at RSS Roof Site as follows.

1. **Remove** fasteners (2 pl) from camera housing front. **Retain** fasteners for reinstallation when front cover is installed.

2. **Install** camera housing front cover using previously removed fasteners (2 pl). **Tighten** fasteners (2 pl) wrench tight.

WARNING

Power cable is live. Care should be exercised when connecting power cable to avoid electric shock.

CAUTION

Do NOT allow back cover to exert undue force on cables when opening/rotating back cover.

3. **Rotate** camera housing back cover into open position by removing bolts with flat washers (20 pl). **Retain** bolts/washers for reinstalllation.

4. **Disconnect:**
   - Power cable
   - Pan & tilt cable
   - Controller cable
   - OTV coaxial cable

5. **Unlock** spring pin at lower, left to release IR camera Unit in camera housing. **Remove** IR Camera Unit from camera housing by carefully sliding it out the back opening of the camera housing. **Support** IR Camera Unit during removal.

6. **Rotate** camera housing back cover into closed position. Do not pinch cables. **Secure** back cover by reinstalling bolts/flat washers (20 pl). **Tighten** bolts wrench tight.

WARNING

Isopropyl Alcohol is flammable and is a skin, eye and respiratory tract irritant that affects the central nervous system. Ensure adequate ventilation, avoid inhalation of vapors and do not use near heat, sparks or open flame. Skin contact may cause redness and pain eye contact will cause severe eye irritation and may result in permanent damage. Inhalation of vapors in high concentrations has a narcotic effect on the central nervous system. Personnel shall wear **N-Dex nitril gloves** and **chemical splash goggles**. When working at eye level or above wear a **face shield** over goggles.

WS002.a 05-22-01

7. **Clean** IR Camera Unit lens plate using (1) roll 8305-00-519-3144 Rymple cloth dampened with (4) ounces 6810-00-543-7915 Isopropyl alcohol.

8. **Route** IR Camera Unit to VAB 3K1 for refurb/checkout.

NASA PH-H _____ Date _____

USA ETM _____ Date _____

Not Performed: N/A

11-25-02

NOTE

IR Camera removal from Camera Site 2 may be not performed in launch scrub turnaround scenarios.

145-2 **Remove** IR camera from Camera Site 2 as follows.

1. **Remove** bolt(s) from camera housing front. **Retain** bolt(s) for reinstallation when front cover is installed.

2. **Install** camera housing front cover using previously removed bolt(s). **Tighten** bolt(s) wrench tight.

WARNING

Power cable is live. Care should be exercised when connecting power cable to avoid electric shock.

CAUTION

Do NOT allow back cover to exert undue force on cables when opening/rotating back cover.

3. **Loosen** screws (8 pl) securing camera housing back cover using Phillips screwdriver. **Rotate** camera housing back cover to open position. **Retain** bolts/washers for reinstallation.

4. **Disconnect:**
   - Power cable
   - Pan & tilt cable
   - Controller cable (2 pl)
   - OTV coaxial cable

5. **Unscrew** set screw(s) at lower, left/right to release IR camera Unit in camera housing. **Remove** IR camera Unit from camera housing by carefully sliding it out the back opening of the camera housing. **Support** IR camera Unit during removal.

6. **Coat** camera housing back cover O-ring with a single coat of (1) tube/jar 6505-00-133-8025 Petroleum Jelly, Vaseline (or equivalent) .

7. **Rotate** camera housing back cover into closed position. Do not pinch cables. **Secure** back cover by installing screws (8 pl). **Tighten** screws wrench tight using Phillips screwdriver.

WARNING

Isopropyl Alcohol is flammable and is a skin, eye and respiratory tract irritant that affects the central nervous system. Ensure adequate ventilation, avoid inhalation of vapors and do not use near heat, sparks or open flame. Skin contact may cause redness and pain eye contact will cause severe eye irritation and may result in permanent damage. Inhalation of vapors in high concentrations has a narcotic effect on the central nervous system. Personnel shall wear **N-Dex nitril gloves** and **chemical splash goggles** . When working at eye level or above wear a **face shield** over goggles.

WS002.a 05-22-01

8. **Clean** IR Camera Unit lens plate using (1) roll 8305-00-519-3144 Rymple cloth dampened with (4) ounces 6810-00-543-7915 Isopropyl alcohol .

9. **Route** IR Camera Unit to VAB 3K1 for refurb/checkout.

NASA PH-H _____ Date _____

KJ A

USA ETM _____ Date _____

FOT MEO5 OR 04 1-6-03

Dev. 145 ADD No. 01 NOV 23 '02 R see DEV

Not Performed: OR 04 FOT MEO5 1-6-03

*** End of Operation **145** ***

OPERATION 150 Final Report

Shop: **SE**
Cntrl Rm Console: **NA**
OPR: **ETM**
Zone: **NA**
Hazard (Y/N): **N**
Duration (Hrs): **0.5**

NOTE
This operation may be not performed after launch scrub.

Operation 150 Not Performed: N/A

150-1 Assemble final report by attaching following reports to this OMI. Reference each to this step.

Post Launch PAD Assessment
SRB Assessment
Launch Film Review
Launch Day Video Review
Orbiter Landing Assessment
ET Separation Review

150-2 Final report assembly complete.

ETM R Brewer Date 01-06-03

150-3 Operation - Final Report complete.

*** End of Operation **150** ***

OMI-$6444, Rev #3 - Step 150-1

Brewer, Raymond J STS-113

From: Oliu-1, Armando [Armando.Oliu-1@ksc.nasa.gov]
Sent: Tuesday, November 26, 2002 9:03 AM
To: Abner, Charlie; 'Adams, Randall'; 'Ayotte, William'; Blue, John B; 'Brown Kenneth'; 'Buckingham, Bruce'; Bulloch-1, Steve; Bursian, Henry; 'Byrne, Greg'; Chitko, Pete J.; 'cookjh@thiokol.com'; 'Derry Steve'; 'Disler, Jon'; 'Disler, Jon (2)'; 'Eastwood Martin'; Estrada-1, Carlos; 'Fricke, Robert'; Gaetjens, William; Glenn-1, Malcolm; 'Gomez Reynaldo'; 'GRP DOC Mission Support Room'; Guidi-1, John; Hawkins, Tyrell; Herman, Robert S; Herst, Terri; Holloway, Darrell L; 'Holmes Steve'; Huff, Joy N.; 'Jay.Sambamurthi@msfc.nasa.gov'; Jones-1, Frank; Kelley-1, David; 'Khodadoust, Abdollah'; Kienitz, Fred; 'Kinder Gerald'; 'Koenig Lisa'; 'Kopfinger, Philip A'; Lafleur, Tom C; Leggett, Kenneth D; Leinbach-1, Mike; 'Linda Ham'; 'Mango, Ed'; 'McClymonds, Jack'; 'MCCORMACK, DONALD L. (DON) (JSC-MV)'; Mosteller-1, Ted; Mulligan-1, Melanie; Nguyen-1, Bao; 'O'Farrell Mike'; 'Ortiz Carlos'; 'Otte Neil'; 'Otto, Scott'; 'Page, Robert'; Payne-1, Michael; 'Ramirez, Juan'; Revay, Kenneth P; 'Rieckhoff, Tom - PC'; 'Rieckhoff, Tom - UNIX'; 'Roe Ralph'; 'Schomburg Calvin'; 'Schricker, B.'; 'snichols@hq.nasa.gov'; Sofge, Al (NASA HQ); 'Speece, Robert'; Stevenson-1, Charlie; 'Stone, Jeff'; Tenbusch-1, Ken; Wells-1, Joel; Wilson, Thomas F.; Rivera, Jorge; Greenwell-1, Shawn; Oliu-1, Armando; Crisafulli, Anthony; Brewer, Raymond J; Marren, Tom; Thompson-1, Becky J.; Key, John; Lorick, Vicky K; Champagne, Lorraine C; Kent, William T. "Tim"; Spaulding-1, Jeff; Altemus-1, Steve; Mullins, Michael B; Powell, Doug; Bauder, Stephen P; Atkinson, Bill C.; "Carlos Ortiz (Boeing) (E-mail) ' (E-mail)'; Hammel-1, Donald
Subject: STS-113 Post Flight Retrieval Assessment

STS-113 SRB POST FLIGHT/RETRIEVAL ASSESSMENT
KSC Debris Team
26 November 2002

The BI-114 Solid Rocket Boosters were inspected for debris damage and debris sources at CCAFS Hangar AF on 26 November 2002. Overall, both boosters were in excellent condition.

ANOMALIES

None

FUNNIES

None

OBSERVATIONS

The TPS on both frustums exhibited no debonds/unbonds. There was minor localized blistering of the Hypalon paint.

All eight BSM aero heat shield covers had fully opened and locked, however one LH cover was missing after it broke due to parachute riser entanglement.

The forward skirts exhibited no debonds or missing TPS. RSS antennae covers/phenolic base plates were intact. All primary frustum severance ring pins and retainer clips were intact.

The Field Joint Protection System (FJPS) and the System Tunnel Covers closeouts were generally in good condition with no unbonds observed.

Separation of the aft ET/SRB struts appeared normal.

Aft skirt external surface TPS was in good condition. Typical blistering of Hypalon paint had occurred on the

insulation close-outs and GEI cork runs.

The holddown post Debris Containment Systems (DCS) appeared to have functioned normally on all HDP's.

No indication of stud hang up was observed.

Armando Oliu
NASA - KSC

OMI-$6444, Run#3, Step 2502/
STS-113

STS-113 SRB POST FLIGHT/RETRIEVAL ASSESSMENT
KSC Debris Team
26 November 2002

The BI-114 Solid Rocket Boosters were inspected for debris damage and debris sources at CCAFS Hangar AF on 26 November 2002. Overall, both boosters were in excellent condition.

ANOMALIES

None

FUNNIES

None

OBSERVATIONS

The TPS on both frustums exhibited no debonds/unbonds. There was minor localized blistering of the Hypalon paint.

All eight BSM aero heat shield covers had fully opened and locked, however one LH cover was missing after it broke due to parachute riser entanglement.

The forward skirts exhibited no debonds or missing TPS. RSS antennae covers/phenolic base plates were intact. All primary frustum severance ring pins and retainer clips were intact.

The Field Joint Protection System (FJPS) and the System Tunnel Covers closeouts were generally in good condition with no unbonds observed.

Separation of the aft ET/SRB struts appeared normal.

Aft skirt external surface TPS was in good condition. Typical blistering of Hypalon paint had occurred on the insulation close-outs and GEI cork runs.

The holddown post Debris Containment Systems (DCS) appeared to have functioned normally on all HDP's.

No indication of stud hang up was observed.

Armando Oliu
NASA – KSC

OMI-$6444, Rev#3, Step 150-1
STS-113

Brewer, Raymond J

From: Oliu-1, Armando [Armando.Oliu-1@ksc.nasa.gov]
Sent: Saturday, December 07, 2002 6:58 PM
To: Abner, Charlie; 'Adams, Randall'; 'Ayotte, William'; Blue, John B; 'Brown Kenneth'; 'Buckingham, Bruce'; Bulloch-1, Steve; Bursian, Henry; 'Byrne, Greg'; Chitko, Pete J.; 'cookjh@thiokol.com'; 'Derry Steve'; 'Disler, Jon'; 'Disler, Jon (2)'; 'Eastwood Martin'; Estrada-1, Carlos; 'Fricke, Robert'; Gaetjens, William; Glenn-1, Malcolm; 'Gomez Reynaldo'; 'GRP DOC Mission Support Room'; Guidi-1, John; Hawkins, Tyrell; Herman, Robert S; Herst, Terri; Holloway, Darrell L; 'Holmes Steve'; Huff, Joy N.; 'Jay.Sambamurthi@msfc.nasa.gov'; Jones-1, Frank; Kelley-1, David; 'Khodadoust, Abdollah'; Kienitz, Fred; 'Kinder Gerald'; 'Koenig Lisa'; 'Kopfinger, Philip A'; Lafleur, Tom C; Leggett, Kenneth D; Leinbach-1, Mike; 'Linda Ham'; 'Mango, Ed'; 'McClymonds, Jack'; 'MCCORMACK, DONALD L. (DON) (JSC-MV)'; Mosteller-1, Ted; Mulligan-1, Melanie; Nguyen-1, Bao; 'O'Farrell Mike'; 'Ortiz Carlos'; 'Otte Neil'; 'Otto, Scott'; 'Page, Robert'; Payne-1, Michael; 'Ramirez, Juan'; Revay, Kenneth P; 'Rieckhoff, Tom - PC'; 'Rieckhoff, Tom - UNIX'; 'Roe Ralph'; 'Schomburg Calvin'; 'Schricker, B.'; 'snichols@hq.nasa.gov'; Sofge, Al (NASA HQ); 'Speece, Robert'; Stevenson-1, Charlie; 'Stone, Jeff'; Tenbusch-1, Ken; Wells-1, Joel; Wilson, Thomas F.; Rivera, Jorge; Greenwell-1, Shawn; Oliu-1, Armando; Crisafulli, Anthony; Brewer, Raymond J; Marren, Tom; Thompson-1, Becky J.; Key, John; Lorick, Vicky K; Champagne, Lorraine C; Kent, William T. "Tim"; Spaulding-1, Jeff; Altemus-1, Steve; Mullins, Michael B; Powell, Doug; Bauder, Stephen P; Atkinson, Bill C.; "Carlos Ortiz (Boeing) (E-mail) ' (E-mail)'; Hammel-1, Donald; Ciccateri, Daniel J
Subject: STS-113 Oribiter Post-Landing Inspection - Preliminary

STS-113 ORBITER POST LANDING INSPECTION
PRELIMINARY DEBRIS ASSESSMENT
7 December 2002

A runway walkdown and preliminary post landing inspection of OV-105 Endeavor was conducted at the Kennedy Space Center on SLF runway 33.

The Orbiter lower surface sustained 64 total hits, of which 13 had a major dimension of 1-inch or larger, both numbers are well within family. The majority of the hits were in the area from the nose landing gear to the main landing gear wheel wells. This area sustained 43 hits with 6 greater than 1-inch. Most of the hits in this area are shallow, indicative of damage from External Tank foam.

The largest lower surface tile damage site, located on the RH inboard elevon, measured 7-inches long by 1-inch wide by 1/2-inch deep. This damage spanned two tiles. The cause of this damage has not been determined yet.

The landing gear tires were reported to be in good condition.

ET/Orbiter separation devices EO-1, EO-2, and EO-3 functioned normally. No ordnance fragments were found on the runway beneath the umbilicals. The EO-2 and EO-3 fitting retainer springs appeared to be in nominal configuration. The EO-2/3 pyro debris shutters were fully closed. No debris was found beneath the umbilicals.

Typical amount of tile damage occurred on the base heat shield. SSME Dome Heat Shield closeout blankets on SSME #1 and #3 were in good condition. The closeout blankets on SSME #2 were frayed from the 12 o'clock to 4 o'clock position.

There were a total of 32 hits on the window perimeter tiles. Hazing and streaking of forward-facing Orbiter windows appears to be normal. A more detailed inspection of the upper surface will be performed in the OPF.

The post-landing walkdown of Runway 33 was performed immediately after landing. All components of the drag chute were recovered and appeared to have functioned normally. An 8-inch long piece of Ames Gap Filler material was found on the runway.

In summary, the Orbiter TPS sustained a total of 96 hits, of which 13 had a major dimension of 1-inch or larger. This total does not include the numerous hits on the base heat shield attributed to SSME vibration/acoustics and exhaust plume recirculation.

The Orbiter post landing assessment will continue in OPF Bay 2 on Monday 12/10/02.

Armando Oliu
NASA - KSC

Robert Speece
NASA - KSC

Jorge Rivera
NASA - KSC

STS-113 Orbiter Debris Mapping...

OMI- $6444, Rev#3, Step 150-1
STS-113

STS-113 ORBITER POST LANDING INSPECTION DEBRIS ASSESSMENT 9 December 2002

After the 2:38 PM local/eastern time landing on 09 December 2002, a post landing inspection of OV-105 Endeavour was conducted at the Kennedy Space Center on SLF runway 33 and in Orbiter Processing Facility bay 2. This inspection was performed to identify debris impact damage and, if possible, debris sources.

The Orbiter TPS sustained a total of 113 hits of which 29 had a major dimension of 1-inch or larger. This total does not include the numerous hits on the base heat shields attributed to SSME vibration/acoustics and exhaust plume recirculation.

The following table lists the STS-113 Orbiter damage hits by area:

	HITS > 1-inch	TOTAL HITS
Lower Surface	14	68
Upper Surface	2	5
Window Area	13	38
Right Side	0	0
Left Side	0	2
Right OMS Pod	0	0
Left OMS Pod	0	0
TOTALS	29	113

The Orbiter lower surface sustained 68 total hits, of which 14 had a major dimension of 1-inch or larger, both numbers are well within family. The majority of the hits were in the area from the nose landing gear to the main landing gear wheel wells. This area sustained 43 hits with 6 greater than 1-inch. Most of the hits in this area are shallow, indicative of damage from External Tank foam.

The largest lower surface tile damage site, located on the RH inboard elevon, measured 7-inches long by 1-inch wide by 1/2-inch deep. This damage spanned two tiles. The cause of this damage has not been determined yet.

The landing gear tires were in good condition.

ET/Orbiter separation devices EO-1, EO-2, and EO-3 functioned normally. No ordnance fragments were found on the runway beneath the umbilicals. The EO-2 and EO-3 fitting retainer springs appeared to be in nominal configuration. The EO-2/3 pyro debris shutters were fully closed. No other debris was found beneath the umbilicals.

Typical amount of tile damage occurred on the base heat shield. SSME Dome Heat Shield closeout blankets on SSME #1 and #3 were in good condition. The closeout blanket on SSME #2 was damaged/frayed from the 12 o'clock to 3 o'clock position. A portion of the OML fabric was missing.

There were a total of 38 hits, with 13 having one dimension greater than 1-inch, on the window perimeter tiles. Hazing and streaking of forward-facing Orbiter windows appears to be normal.

The post-landing walkdown of Runway 33 was performed immediately after landing. All components of the drag chute were recovered and appeared to have functioned normally. An 8-inch long piece of Ames Gap Filler material was found on the runway.

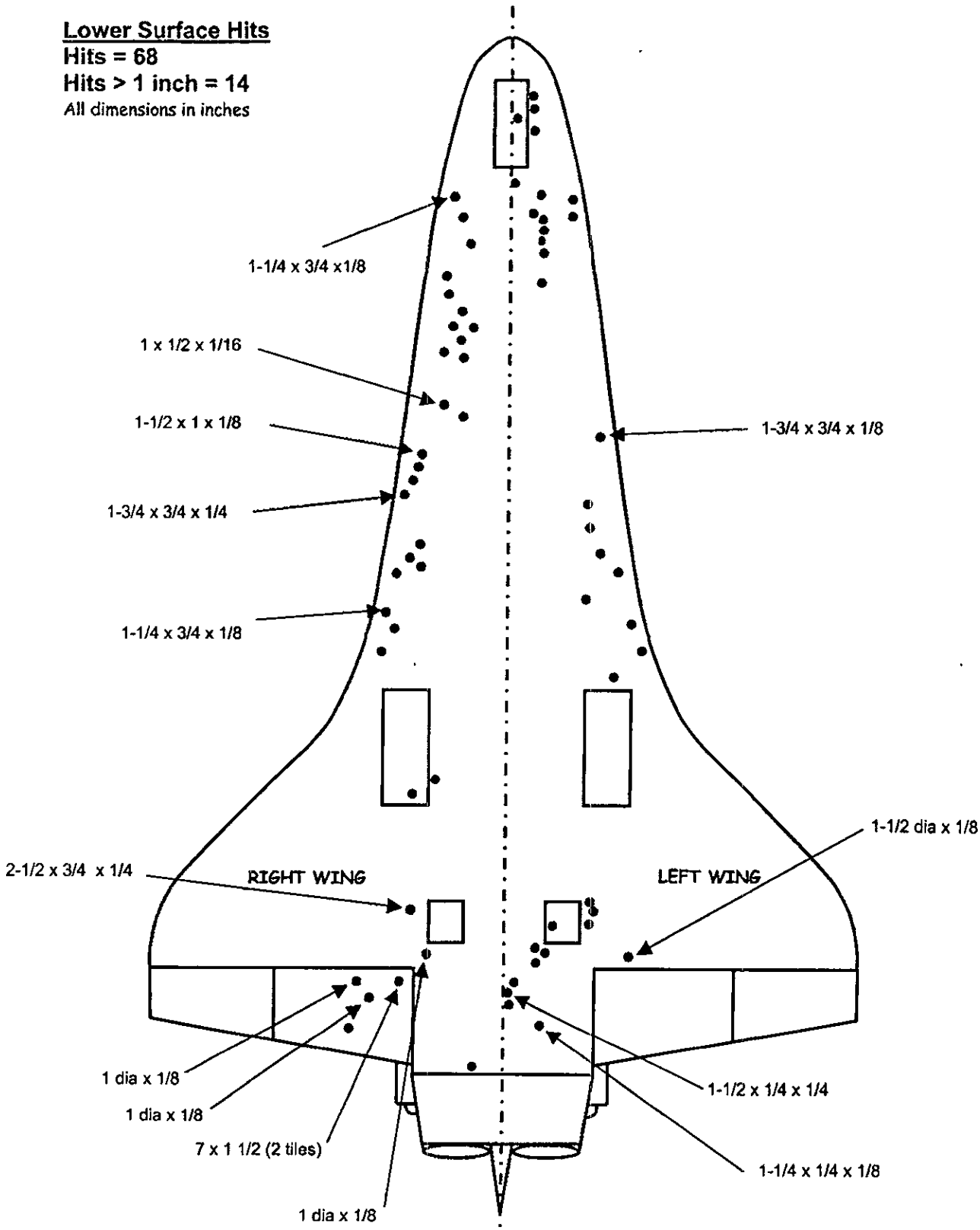
In summary, the total number of Orbiter TPS debris hits and the number of hits 1-inch or larger were within established family. However, the number of hits between the nose landing gear and main landing gear wheel wells is slightly higher than normal. The potential identification of debris damage sources for mission STS-113 will be based on the laboratory analysis of Orbiter post landing microchemical samples, inspection of the recovered SRB components, film analysis, and aerodynamic debris particle trajectory analysis. The results of these analyses will be documented in the STS-113 Debris/Ice/TPS Assessment and Integrated Photographic Analysis report.

Armando Oliu
NASA - KSC

Robert Speece
NASA - KSC

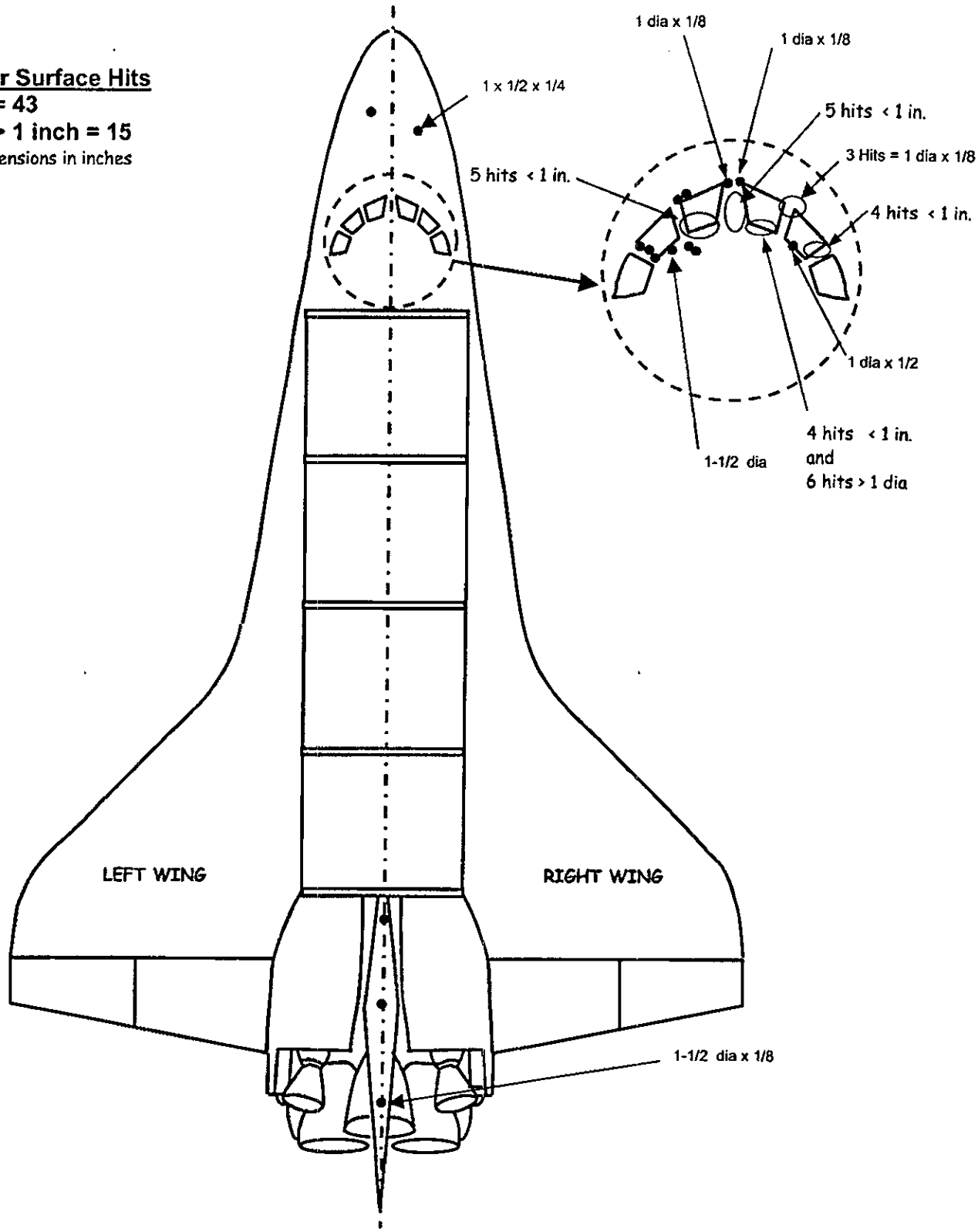
DEBRIS DAMAGE LOCATIONS

Lower Surface Hits
Hits = 68
Hits > 1 inch = 14
All dimensions in inches



DEBRIS DAMAGE LOCATIONS

Upper Surface Hits
Hits = 43
Hits > 1 inch = 15
All dimensions in inches



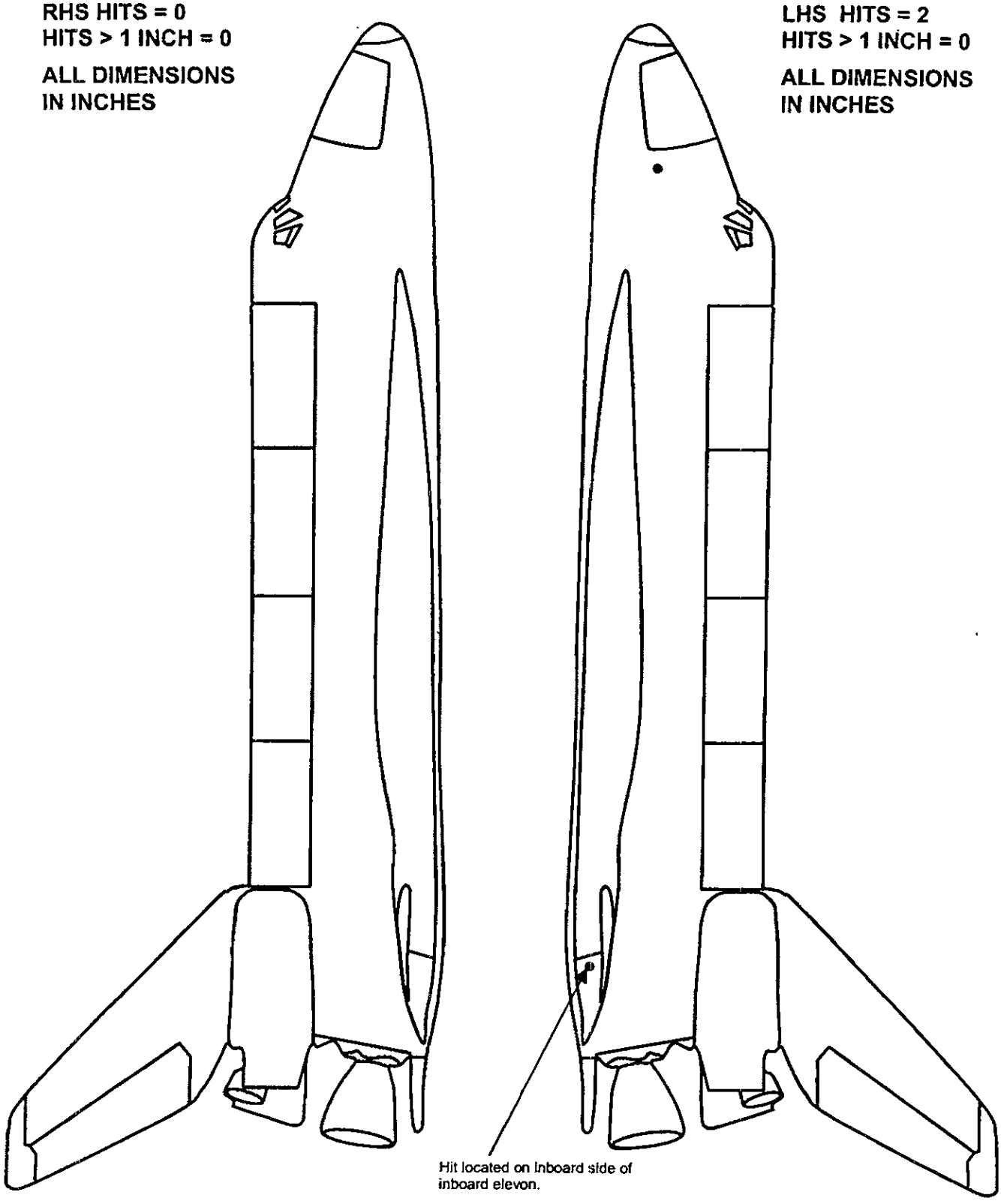
DEBRIS DAMAGE LOCATIONS

RHS HITS = 0
HITS > 1 INCH = 0

ALL DIMENSIONS
IN INCHES

LHS HITS = 2
HITS > 1 INCH = 0

ALL DIMENSIONS
IN INCHES



OMI-$6444, Run#3, Seq 150-1
STS-113

Brewer, Raymond J

From: Oliu-1, Armando [Armando.Oliu-1@nasa.gov]
Sent: Wednesday, December 18, 2002 9:39 AM
To: Abner, Charlie; 'Adams, Randall'; 'Ayotte, William'; Blue, John B; 'Brown Kenneth'; 'Buckingham, Bruce'; Bulloch-1, Steve; Bursian, Henry; 'Byrne, Greg'; Chitko, Pete J.; 'cookjh@thiokol.com'; 'Derry Steve'; 'Disler, Jon'; 'Disler, Jon (2)'; 'Eastwood Martin'; Estrada-1, Carlos; 'Fricke, Robert'; Gaetjens, William; Glenn-1, Malcolm; 'Gomez Reynaldo'; 'GRP DOC Mission Support Room'; Guidi-1, John; Hawkins, Tyrell; Herman, Robert S; Herst, Terri; Holloway, Darrell L; 'Holmes Steve'; Huff, Joy N.; 'Jay.Sambamurthi@msfc.nasa.gov'; Jones-1, Frank; Kelley-1, David; 'Khodadoust, Abdollah'; Kienitz, Fred; 'Kinder Gerald'; 'Koenig Lisa'; 'Kopfinger, Philip A'; Lafleur, Tom C; Leggett, Kenneth D; Leinbach-1, Mike; 'Linda Ham'; 'Mango, Ed'; 'McClymonds, Jack'; 'MCCORMACK, DONALD L. (DON) (JSC-MV)'; Mosteller-1, Ted; Mulligan-1, Melanie; Nguyen-1, Bao; 'O'Farrell Mike'; 'Ortiz Carlos'; 'Otte Neil'; 'Otto, Scott'; 'Page, Robert'; Payne-1, Michael; 'Ramirez, Juan'; Revay, Kenneth P; 'Rieckhoff, Tom - PC'; 'Rieckhoff, Tom - UNIX'; 'Roe Ralph'; 'Schomburg Calvin'; 'Schricker, B.'; 'snichols@hq.nasa.gov'; Sofge, Al (NASA HQ); 'Speece, Robert'; Stevenson-1, Charlie; 'Stone, Jeff'; Tenbusch-1, Ken; Wells-1, Joel; Wilson, Thomas F.; Rivera, Jorge; Greenwell-1, Shawn; Oliu-1, Armando; Crisafulli, Anthony; Brewer, Raymond J; Marren, Tom; Thompson-1, Becky J.; Key, John; Lorick, Vicky K; Champagne, Lorraine C; Kent, William T. "Tim"; Spaulding-1, Jeff; Altemus-1, Steve; Mullins, Michael B; Powell, Doug; Bauder, Stephen P; Atkinson, Bill C.; "Carlos Ortiz (Boeing) (E-mail) ' (E-mail)'; Hammel-1, Donald; Ciccateri, Daniel J
Subject: STS-113 Landing and Umbilical Well Film review

STS-113 LANDING and ON-ORBIT FILM SUMMARY
KSC Photo/Video Analysis Team
16 December 2002

The last film/video data, 16mm and 35mm landing films, and 16mm motion picture with 5mm and 10mm lens from the LH2 ET/ORB umbilical cameras were received and reviewed at KSC. There was no 35mm umbilical film, as well as Crew Hand-held, after ET/Orbiter separation due to low light conditions.

ET Separation

ET 05

12/17/02

ANOMALIES

None.

FUNNIES

None.

Observations:

All landing events appeared nominal.

SRB separation from the External Tank appeared nominal.

There was typical charring and "popcorning" of ET foam during ascent.

Armando Oliu
NASA - KSC

```
*************************************************
*                                               *
*        PROGRAM PRA120 SELECTION CRITERIA      *
* --------------------------------------------- *
*                                               *
*        RPT TYPE: IPR                          *
*                                               *
*        PR GROUP:                              *
*                                               *
*    WORK AREA CD:                              *
*                                               *
*      PR ELEM CD:                              *
*                                               *
*          STS NO:                              *
*                                               *
* Starting RPT DT: 11/23/02                     *
*                                               *
*   Ending RPT DT: 01/06/03                     *
*                                               *
*  LRU or Non-LRU: B                            *
*                                               *
*    PRACA EFF CD:                              *
*                                               *
*            EICN:                              *
*                                               *
*      RPT STATUS: OP                           *
*                                               *
* DETECTED DURING: S6444                        *
*                                               *
* --------------------------------------------- *
* Sorted by DETECTED DURING, PR ELEM CD, and EICN *
*                                               *
*************************************************
```

```
**********************************************************************
*                                                                    *
* NO DATA FOUND ON THE DATABASE FOR THE SELECTED PARAMETERS          *
*                                                                    *
**********************************************************************
```

```
******************
*                *
* END OF REPORT  *
*                *
```

DEVIATION INDEX

WAD NO.

☒ PERMANENT ☐ TEMPORARY ☐ TEMP RECYCLE

S6444 REV: J CHG:04 (OMI)

DATE/TIME: 06/06/2002 07:56:26

TASK NO./SEQ. NO. 90

DEV NO.	SEQ/ STEP	EFFECTIVITY	QC/ PP&C	DATE	REMARKS
90-01	90 4		*	2002-06-05	

JAN 23 '03

United Space Alliance

TOP/WAD Deviation

Dev No. 90/01	DILS No. 98124 (S)	Page 1 of 1

TOP/WAD No.	REV/CHG/VER	In Family / Out of Family / NMA	Cause Code: Requesting or Causing Org (B,D,E,G,H,L,N,O,P,Q,S,T,V)	Cause Code: Reason (10-Tech Chg 20-Proc Chg 30-Auth Error 40-Rewrite)
S6444	J04	[ ] In Family [ ] Out of Family [X] NMA	E	20

First Use: [ ] SRB BI- [X] ET 093 [ ] GSE [ ] STS-

Effectivity: [ ] ORB /FLT [ ] FRCS/POD /FLT [ ] SSME /FLT

Affected: [ ] OMRS/ACOMC/OMP [ ] Design Req'ts [ ] Haz Step(s) [ ] PPE [X] Internal Review Req.

Contractor OSR	Contractor Test Conductor	Gov't OSR
R Brewer 06-04-02		06-04-02
Contractor Test Project Engineer	Other SE Chief 06-04-02	Gov't Project Engineer
Contractor Safety	Other	Gov't Test Director or Contractor Chief TC

Page Number: 90-3 Step Number: 90-4

Add the following new step:

90-4.1 **Monitor** the ET GOX Vent Land area after GOX Vent Hood retraction using cameras no. 013/113, 060/160, 062/162, 068/168 and 069/169 for potential Topcoat Paint/TPS damage. **Record** results below.

Results N/A

ETM _____ Date _____

N/P

Originator (print)	SPDMS ID	Phone	Organization	Date	[X] Perm [ ] Temp [ ] Temp-Recycle
R. Brewer	ZQ6345	1-4429	ETM	06/04/2002	

DEVIATION INDEX

☐ PERMANENT ☐ TEMPORARY ☑ TEMP - RECYCLE

WAD NO. S6444-J04

TASK NO./SEQ. NO. 145

DEV NO.	SEQ/ STEP	EFFECTIVITY	QC/ PP&C	DATE	REMARKS
145/01	145-2.9	1/3V105/019	SPO 882	[illegible]	

SPO 119

JAN 23 '03

United Space Alliance

TOP/WAD Deviation

Dev No. 145-01	DILS No. 101919	Page 1 of 1

TOP/WAD No.	REV/CHG/VER		Cause Code	
			Requesting or Causing Org (B,D,E,G,H,L,N,O,P,Q,S,T,V)	Reason 10-Tech Chg 20-Proc Chg 30-Auth Error 40-Rewrite
S6444	J04	☐ In Family ☒ Out of Family ☐ NMA	E	20

First Use ☐ SRB BI- ☐ ET ☐ GSE ☒ STS-113
Effectivity: ☐ ORB /FLT ☐ FRCS/POD /FLT ☐ SSME /FLT

Affected: ☐ OMRS/ACOMC/OMP ☐ Design Req'ts ☐ Haz Step(s) ☐ PPE ☐ Internal Review Req.

Contractor OPR	Contractor Test Conductor	Gov't OPR
R Brewer 11-23-02		A. Olin 11/23/02
Contractor Test Project Engineer	Other SE Effect 11-23-02	Gov't Project Engineer
Contractor Safety	Other	Gov't Test Director or Contractor Chief TC

Page Number: 145-5 Step Number: 145-2.9

After this step, add the following new steps:

145-3 Post Launch of SRBs:

At Hanger "AF", during open assessment, document / photograph as required.

SPC No. N/A Disc / Frame No. N/A

PH-H A. Olin Date 11/26/02

145-4 Post Landing Orbiter / Runway Inspection:

1. Photograph debris and any flight hardware found during Orbiter post landing debris walkdown.

2. Photograph any observations found during Orbiter post landing debris inspection and TPS damage mapping.

SPC No. 51365 Disc / Frame No. 1-52

PH-H A. Olin Date 12/7/02

ETM [illegible] Richards Date 12-7-02

Originator (print)	SPDMS ID	Phone	Organization	Date	☐ Perm ☐ Temp
R. Brewer	ZQ6345	1-4429	ETM	11/22/2002	☒ Temp-Recycle

USA 9364 Rev. 6-02

USA

Pen and Ink Change Record

5

JREVISION	S6444 / J04	EFFECTIVITY	BI-113, ET-113	
racking Number	Page	Seq/Op - Step		Eng Approval
02-FR3-070902	60-8	Table 60-1		MS 17

Add Camera 063/163 ~~Specifications~~ OR 5-30-02

SRB AND ORBITER WING TO NEW CENTERED 5/24/02

FOR LH2 FIRE DETECTION SYSTEM (BUTCHER PAPER)

OR 02

Tracking Number	Page	Seq/Op - Step	Eng Approval

Tr mber	Page	Seq/Op - Step	Eng Approval

Tracking Number	Page	Seq/Op - Step	Eng Approval

Tracking Number	Page	Seq/Op - Step	Eng Approval

SU Date

JAN 23